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A STUDY OF POLICIES, GUIDELINES, AND ENFORCEMENT PROCEDURES AFFECTING PREVENTION, CONTROL, AND ABATEMENT OF AIR AND WATER POLLUTION RESULTING FROM FORESTRY PRACTICES ON THE FLATHEAD NATIONAL FOREST, MONTANA

MONTANA UNIVERSITY

PREPARED FOR
ENVIRONMENTAL PROTECTION AGENCY

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BY

THE UNIVERSITY OF MONTANA

SCHOOL OF FORESTRY

FOR

THE ENVIRONMENTAL PROTECTION AGENCY

REGION VIII, DENVER, COLORADO

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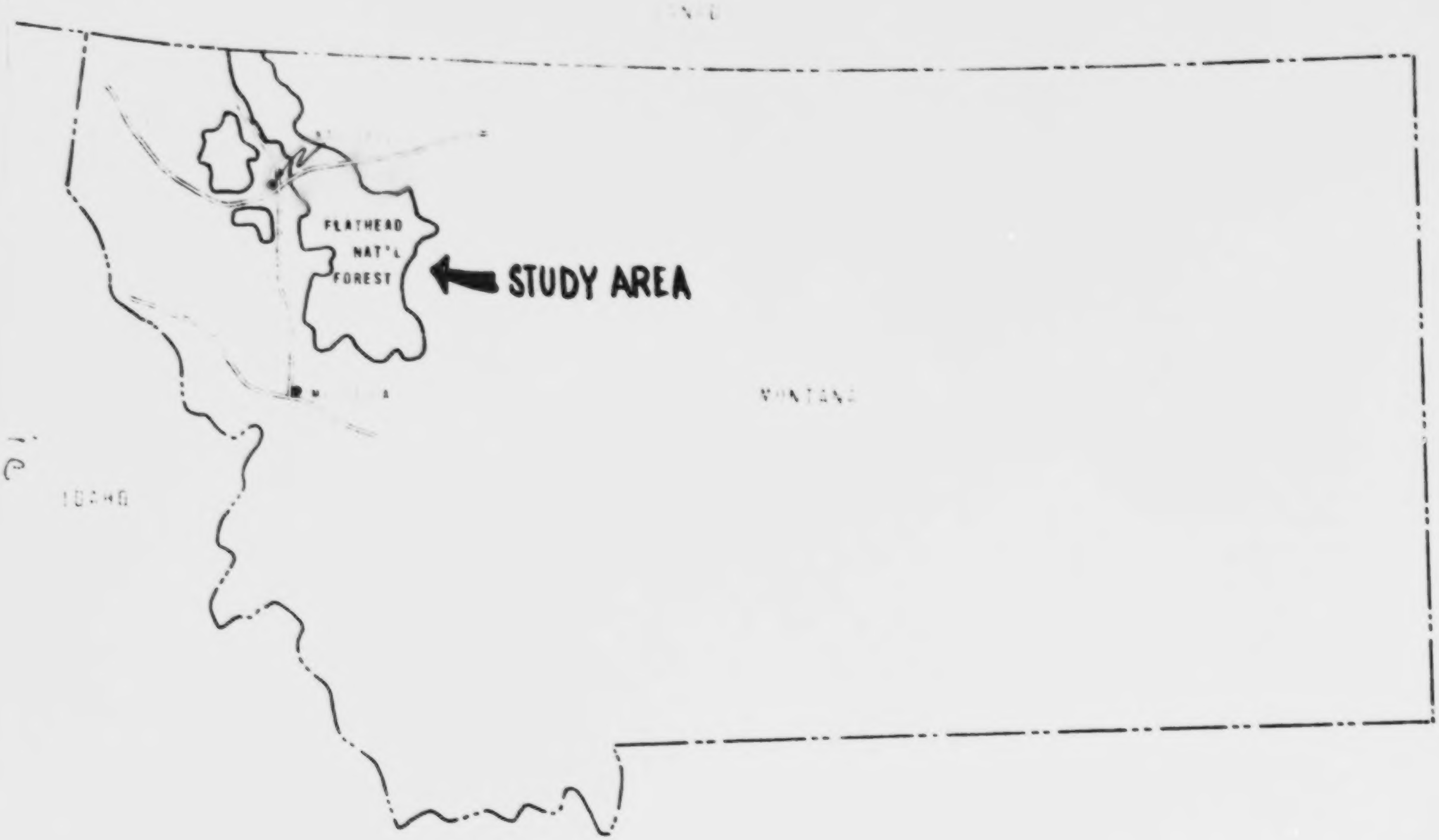
FLATHEAD
NAT'L
FOREST
STUDY AREA
MONTANA
IDAHO

INTRODUCTION

In June of 1973 the Environmental Protection Agency entered into a contract with the University of Montana to conduct "A Study of Policies, Guidelines and Enforcement Procedures Affecting Prevention, Control and Abatement of Air and Water Pollution Resulting from Forestry Practices on the Flathead National Forest."

An initial purpose of this study was to help provide a basis for the identification and control of nonpoint sources of pollution as stipulated in the Water Pollution Control Act Amendments of 1972, 33 USC 1251. The study was enlarged to consider provisions of the Clean Air Act PL 42 USC 1857, the Natural Environmental Policy Act of 1969, 42 USC 4321, and related Executive Orders and supplementary orders published since then in the Federal Register.

The Flathead National Forest was selected for study by the EPA and by the Forest Service. The Flathead National Forest is located on the western slope of the Continental Divide in northwestern Montana. The majority of its 2,347,229 acres lies within Flathead and Lake Counties with smaller areas extending into Lincoln County to the west and Missoula, Powell and Lewis and Clark Counties to the south. Most of the national forest is drained by the three forks of the Flathead River and an adjacent tributary the Stillwater River. The Swan River drainage comprises the remaining area and joins the Flathead River in Flathead Lake.

The Flathead National Forest covers most of the upper watershed of the Flathead River draining into Flathead Lake. The only other major portion of the Flathead drainage is the western portion of Glacier National Park. Some of the headwater area of the north fork of the Flathead River is in Canada.

Most of the Flathead National Forest is quite rugged and steep, particularly in the Mission Mountains, the Swan Range, and along the Continental Divide. Elevations vary from 2,900 feet in the Flathead Valley to about 8,500 feet in the higher mountain ranges. Most of the land is in solid block ownership. The valley bottoms of the larger drainages are in private ownership. In the Swan drainages an extensive area of alternate sections belongs to the Burlington-Northern Company.

The forest provides a considerable flow of timber to the mills in the Flathead Valley, a wide variety of high quality recreation varying from intensive use in the valleys to the heavy but dispersed use of the Bob Marshall Wilderness. It is an important producer of high quality water, it provides excellent hunting and fishing, and is recognized as one of the most scenic areas of the northern Rocky Mountain region. Its amenity values enhance the lives of the residents, and a large rapidly increasing number of people from throughout the nation and, in fact, the world. The uses of the Flathead National Forest have varying effects on the quality of the environment.

The Flathead National Forest is administered under the Multiple Use-Sustained Yield Act, which is designed to provide a sustained flow of multiple values and products for the continuing use and enjoyment of the American people. In its operations it is, of course, subject to the national laws requiring protection of environmental quality.

In addition, the officials of the Forest Service have adopted policies and guidelines to protect and enhance environmental quality. These policies and guidelines are promulgated at the Washington level, and interpreted at the regional office and forest supervisor levels, by documents which supplement the national policies and guidelines. These policies and guidelines and their interpretations are translated into direct action through contracts and other agreements with forest users. The forest with support and supervision of the regional office has direct responsibility for enforcing the policies and guidelines during the operations on the forest. The final test of the effectiveness of the policies and guidelines on the national forests is in a review of what actually takes place in the field.

The study was carried out by a group of faculty of the School of Forestry of the University of Montana, from late June to November 1973, in response to a request by the Environmental Protection Agency, who supported it.

The team consisted of twelve faculty members:

Richard W. Behan, Associate Professor, Forest Policy and Administration

Arnold W. Bolle, Professor, Administration, Economics and Policy (Director of the Study)

Lee E. Eddleman, Associate Professor, Range Management and Conservation

James L. Faurot, Associate Professor, Silviculture and Engineering

Lawrence K. Forcier, Assistant Professor, Ecology and Watershed Studies

Thomas J. Nimlos, Professor, Forest Soils

W. Leslie Pengelly, Professor, Wildlife Biology

Nellie M. Stark, Associate Professor, Soils and Ecology

Robert W. Steele, Associate Professor, Forest Fire Science

Robert F. Wambach, Dean, Economics and Forest Management

Earl E. Willard, Assistant Professor, Range Management and Soils

The team worked in two groups, one focusing on policies, guidelines and operations, the other on various aspects of forest science. Richard Behan, Arnold Boile, and Dean Robert Wambach, all with backgrounds in policy, economics and management constituted the group studying the policies, guidelines and operations. The scientific team was composed of Larry Forcier and James Faurot in forest ecology and silviculture, Nellie Stark and Tom Nimlos in forest soils, Lee Eddleman, Les Pengelly and Earl Willard in forage and wildlife ecology, and Robert Steele, forest fire science.

Dean Wambach, Eddleman, Stark and Nimlos contributed time to the study. All of the other faculty were assigned time and funds to carry on the study.

The study was given the full support of the Forest Service. Conferences and interviews were conducted with the regional forester, Steve Yurich and his staff. Ed Corpe, Supervisor of the Flathead National Forest gave his full support and made his staff and the district staffs available to us. The cooperation was open and friendly throughout. The group worked in teams and individually; visiting field operations, examining documents, files and other materials in the Supervisor's and regional offices.

The team also met with officials of State agencies in Helena and Missoula and was given full cooperation and needed documentation by them.

I. FEDERAL AND STATE LEGISLATION, ORDERS AND GUIDELINES DEALING WITH WATER AND AIR POLLUTION

A. Federal Legislation

The basic Federal Water Pollution Control Act was passed in 1956, the Federal Air Pollution Control Act in 1965. Both Acts have been amended and strengthened several times since then. The most comprehensive of the Water Pollution Control Act Amendments are those of 1972, of the Clean Air Act Amendments, those of 1970. These amendments expanded the National Environmental Control Act of 1969 (NEPA) and are closely allied to subsequent Executive Orders and Guidelines printed in the Federal Register.

This body of law represents the basis for the actions of Federal agencies regarding environmental quality. NEPA declares "a national policy which will encourage productive and enjoyable harmony between man and his environment; promote efforts which will prevent or eliminate damage to the environment." The Water Pollution Control Act states that its objective "is to restore and maintain the chemical, physical and biological integrity of the Nation's water." The Clean Air Act's purpose is "to protect and enhance the quality of the Nation's air resources."

The Forest Service is a conservation agency of long standing and operates largely on the basis of laws passed specifically for it, particularly in the environmental area. It is to some extent a new experience for the Forest Service to be subject to environmental laws that are not specific for the Forest Service, as these are. These laws are declared "supplemental" to each agency's "existing authority" and "a mandate to view the traditional policies in the light of the Act's national environmental objectives." "Each agency...shall comply unless existing law prohibits." The laws apply to agencies, including the Forest Service, as they apply to any individual citizen. But compliance is not enough for the Forest Service or any other agency, the directive is clear that "the Federal Government...shall provide leadership in the national effort to protect the quality of our air, water and land resources..."

Water Pollution Control Act Amendments of 1972 PL 92-500

The Federal Water Pollution Control Act Amendments of 1972 charged the Administrator of the Environmental Protection Agency with developing a program for the identification and control of nonpoint pollution generated by silvicultural activities on forest lands. The Act establishes a national goal to eliminate the discharge of pollutants into all waters of the nation by 1985. For nonpoint sources including forest lands a further goal is set. (Section 101 (a)(2)):

> "it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and for recreation in and on the water be achieved by 1983;"

In doing so existing state and federal programs will be used (Sec 102 (a)). At the State level areawide waste treatment programs will be the basis of pollution control (Sec 201 (c)). The Administrator is authorized to "undertake technical, legal, institutional, and economic studies to serve as the basis for further evolution and development of nonpoint source control programs" (Sec 104). Special reference is made to nonpoint sources of pollution throughout the Act. Section 201 (c) specifies that waste treatment management plans shall "provide control or treatment of all point and nonpoint sources of pollution." Section 208 (b) (2) (F), calling for a planning process to be in effect within one year, requires that "any plan prepared...shall include... a process to (i) identify, if appropriate,...silviculturally related nonpoint sources of pollution...and, (ii) set forth procedures and methods (including land use requirement) to control to the extent feasible such sources."

Section 304 (e) specifies "the Administrator...shall issue to appropriate Federal agencies...within one year of the effective date of this subsection...information including (1) guidelines for identifying, and evaluating the nature and extent of nonpoint sources of pollutants, and (2) processes, procedures, and methods to control pollution resulting from... silvicultural activities, including runoff from...forest lands."

Each State is required, by Section 305 (b) (1), to prepare a report to the Administrator of EPA by January 1, 1975 (and annually thereafter) "which shall include - a description of the nature and extent on nonpoint sources of pollutants, and recommendations as to the programs which must be undertaken to control each category of such sources, including an estimate of the costs of implementing such program."

The legislative history of the 1972 Act amendments make clear the intent to control nonpoint sources of pollution and specifically those in runoff from forest lands in order to achieve the national goal specified in the Act.

The thrust of the Act is to require the development of a program to identify and begin control of nonpoint sources of pollution within the next two years and to develop a feasible system of controlling nonpoint sources of pollution to meet the 1983 interim goals.

The Act calls for a coordinated program of existing federal and state agencies working through a new arrangement: the areawide waste treatment management planning. The "primary responsibility of States to prevent, reduce and eliminate pollution" is recognized (Section 101 (b)). In developing the programs the Administrator is directed to work "in cooperation with other Federal agencies, State water pollution control agencies, interstate agencies, and the municipalities and industries involved" (Section 102 (a)). After such consultation the Administrator, within 90 days after enactment, is to issue instructions for identifying those areas which "have substantial water quality control problems," (Section 208 (a) (1)). Sixty days later each Governor is required to identify these areas in his state and designate a "single representative agency" to be in charge of planning, (Section 208 (a) (2)). Within one year the designated organization is to have "in operation a continuing areawide waste treatment management planning process," (Section 208 (b) (1)).

Each state is required to adopt water quality standards which may be stricter but not weaker than federal requirement, (Sec. 301). The Administrator of EPA will develop the criteria for water quality "after consultation with appropriate Federal and State agencies." Under Section

309 the Administrator of EPA is empowered to bring civil action against any person in violation of the Act. Under Section 402 the EPA has authority to directly control point sources of pollution. Federal facilities are recognized as point sources. Executive Order 11752 published in the Federal Register Dec. 19, 1973, includes land in the category of federal facilities. How this will operate and how State agencies may operate or cooperate in enforcement of the provisions of this Act is not clear. However, provision is made for citizen suits "against any person including the United States...who is alleged to be in violation".

The Act provides for many opportunities for implementation of the program in addition to control. In Section 104 the Administrator of EPA is directed to "conduct and promote, in cooperation with Federal, State and local agencies, training and demonstrations relating to the causes, effects, extent, prevention, reduction and elimination of pollution." In doing so, the Administrator is empowered to make grants or enter into contracts with public and private institutions to carry on the training. Courses can be developed to assist government officials and industry personnel in ways to control pollution caused by runoff from forested lands, for example.

Clean Air Amendments of 1970 PL 91-604

The Clean Air Act was first passed in 1965 and amended in 1966, 1967 and 1970. It recognizes the problem of air pollution, and its basic purpose is to provide assistance to state and local governments which are given primary responsibility. The purposes are specified: "to protect and enhance the quality of the Nation's air resources...to initiate and accelerate...research...to provide technical and financial assistance, and to encourage regional air pollution control programs."

There is again a special admonition to Federal agencies:

> "Each department, agency, and instrumentality of the executive, legislative, and judicial branches of the Federal Government (1) having jurisdiction over any property or facility, or (2) engaged in any activity resulting, or which may result, in the discharge of air pollutants, shall comply with the Federal, State, interstate, and local requirements respecting control and abatement of air pollution to the same extent that any person is subject to such requirements."

The Federal Act provides standards and works through the States. States are required to set standards which are required to be at least as strict as Federal standards. Enforcement is by the State with Federal oversight. Section 309 of the Clean Air Act gives authority for the review of Environmental Impact statements to the Environmental Protection Agency (EPA).

Executive Order 11602, July 1, 1971, providing for the administration of the Clean Air Act with respect to Federal contracts, specifies that "each agency empowered to enter into contracts for procurement or services...shall undertake such activities in a manner that will result in effective enforcement of the Clean Air Act."

The National Environmental Policy Act of 1969 (NEPA) (PL 91-190) signed January 1, 1970 established the Council for Environmental Quality (CEQ). The right of each person to enjoy a healthful environment as well as his responsibility to contribute to the preservation and enhancement of the environment was recognized.

All agencies of the Federal government were directed to:

> (A) utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment,
>
> (B) identify and develop methods and procedures, in consultation with the CEQ...which will insure that presently unquantifiable environmental amenities and values may be given appropriate consideration in decision making along with the economic and technical considerations;
>
> (C) include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on--
>
> (i) the environmental impact of the proposed action,
> (ii) and adverse environmental effects which cannot be avoided should the proposal be implemented,
> (iii) alternatives to the proposed action,
> (iv) the relationship between the short term uses of man's environment and the maintenance and enhancement of long-term productivity, and
> (v) irreversible and irretrievable commitments of resources which should be involved in the proposed action should it be implemented.

This is the section which forms the basis for the environmental impact statements now required of Federal agencies. These statements are to be made available to other agencies, to the public, and, of course, the CEQ, in advance of taking the proposed action.

There are other requirements to provide assistance to State agencies. All Federal agencies are also directed to review their authority, administrative regulations, policies, procedures to determine any deficiencies or inconsistencies with NEPA by July 1, 1971 and to make the changes needed to comply. The agencies are also instructed to comply with all other environmental laws (such as Water Pollution Control and Air Quality Acts and others).

Executive Order 11514

In Executive Order 11514, March 5, 1970, Protection and Enhancement of Environmental Quality, quoting his authority under NEPA, the President ordered as follows:

> Section 1. Policy. The Federal Government shall provide leadership in protecting and enhancing the quality of the Nation's environment to sustain and enrich human life. Federal agencies shall initiate measures needed to direct their policies, plans and programs so as to meet national environmental goals...
>
> Section 2. Responsibilities of Federal Agencies. (a) Monitor, evaluate, and control on a continuing basis their agencies' activities so as to protect and enhance the quality of the environment. Such activities shall include those directed to controlling pollution and enhancing the environment and those designed to accomplish other program objectives which may affect the quality of the environment...

Revised Guidelines for Environmental Impact Statements - August 1, 1973

In response to widespread comment that the CEQ should increase the opportunity for public comment in the impact statement process and that the CEQ should provide more detailed guidance on the responsibilities of Federal agencies in the light of recent court decisions interpreting the Act, the CEQ on August 1, 1973 published new guidelines for the preparation of Environmental Impact Statements.

Referring both to NEPA and Executive Order 11514 the Guidelines emphasize that "all Federal agencies, to the fullest extent possible, direct their policies, plans and programs to protect and enhance environmental quality." The environmental impact statement "requires agencies to build into their decision making process, beginning at the earliest possible point, an appropriate and careful consideration of the environmental aspects of the proposed action in order that adverse environmental effects may be avoided or minimized and environmental quality previously lost may be restored."

In identifying the actions affecting the environment, agencies are directed to consider the "overall, cumulative impact." Individual actions "may be localized in their impact, but if there is potential that the environment may be significantly affected, the statement is to be prepared. Proposed major actions, the environmental impact of which is likely to be highly controversial, should be covered in all cases." "The Act also indicates that adverse significant effects include those that degrade the quality of the environment, curtail the range of beneficial uses of the environment, and serve short term, to the disadvantage of long-term, environmental goals."

"In particular, agencies should keep in mind that...statements are to serve as the means of assessing the environmental impact of proposed agency actions, rather than as justification statements for decisions already made."

As to content of the impact statements, the guidelines require the following:

> "(1) A description of the proposed action, a statement of its purposes and a description of the environment affected, including information, summary technical data, and maps and diagrams where relevant. The interrelationships and cumulative environmental impact...shall be presented... Agencies should also take care to identify, as appropriate, population and growth characteristics of the affected area and any population and growth assumptions..." (emphasis added in all cases)
>
> "(2) The relationship of the proposed action to land use plans, policies and controls of the affected area. This requires a discussion of how the proposed action may conform or conflict with the objectives and specific terms of

> approved or proposed Federal, State and local land use plans, policies and controls, if any, for the area including those developed in response to the Clean Air Act or the Federal Water Pollution Control Act Amendments of 1972."
>
> "(3) The probable impact of the proposed action on the environment.
> (i) This requires agencies to assess the positive and negative effects of the proposed action... Primary attention should be given...to discussing those factors most evidently impacted by the proposed action.
> (ii) Secondary or indirect, as well as primary or direct consequences...should be included."
>
> "(4) A rigorous exploration and objective evaluation of the environmental effects of all reasonable alternative actions."
>
> "(5) Any adverse environmental effects which cannot be avoided..."
>
> "(6) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity..."
>
> "(7) Any irreversible and irretrievable commitments of resources...the extent to which the action irreversibly curtails the range of potential uses of the environment..."

In order to meet NEPA's precept to "utilize a systematic, interdisciplinary approach" the Guidelines say:

> "Agencies should attempt to have relevant disciplines represented on their own staffs; where this is not feasible they should make appropriate use of relevant Federal, State, and local agencies or the professional services of universities and outside consultants. The interdisciplinary approach should not be limited to the preparation of the environmental impact statement, but should also be used in the early planning stages of the proposed action. Early application of such an approach should help assure a systematic evaluation of reasonable alternative courses of action and their potential social economic, and environmental consequences."

Provision for review of draft environmental statements are made by Federal and State agencies with jurisdiction by law or special expertise, by the EPA, and by the public. Special emphasis is given to public participation. In discussing responsibilities of commenting entities the guidelines urge commenters to "endeavor to make their comments as specific, substantive, and factual as possible."

An area for specific comment is introduced:

> "Agencies and members of the public should indicate in their comments the nature of any monitoring of the environmental effects of the proposed project that appears particularly appropriate. Such monitoring may be necessary during the construction, startup, or operation phases of the project. Agencies with special expertise with respect to the environmental impacts involved are encouraged to assist the sponsoring agency in the establishment and operation of appropriate environmental monitoring."

The Guidelines make it plain the NEPA applies to existing projects and programs that were started before the Act was passed:

> "Agencies have an obligation to reassess ongoing projects and programs in order to avoid or minimize adverse environmental effects. The section 102 (2) (C) procedure shall be applied to further federal actions having a significant effect on the environment even though they arise from projects or programs initiated prior to enactment of the Act on January 1, 1970 ...it is essential that the environmental impacts of proceeding are reassessed pursuant to the Act's policies and procedures and, if, the project or program is continued, that further incremental actions be shaped so as to enhance and restore environmental consequences. It is also important in further action that account be taken of environmental consequences not fully evaluated at the outset of the project or program."

B. Guidelines and Policies of the State of Montana Agencies to Effect Control of Air and Water Pollution Resulting from Forestry Operations

The legislature and agencies of the State of Montana have established laws and procedures and the means of controlling air and water pollution in the State. Several agencies are also preparing new laws for the legislature and regulations to more fully comply with Federal legislation and to strengthen the requirements and the power to control air and water pollution. The Department of Health and Environmental Sciences (DH & ES) has primary responsibility for air and water pollution control. The Environmental Quality Council administers Montana's Environmental Policy Act. The Department of Natural Resources and Conservation (DNR & C) and the Fish and Game Department carry no direct authority but their activities are so deeply involved in air and water quality that a description of their activities is included.

Water Pollution Control

The State government of Montana is taking the steps prescribed under Section 208 of the Water Pollution Control Act Amendments of 1972. The Governor has identified the areas in the state which "have substantial wate water quality control problems." He has designated the Department of Health and Environmental Sciences (DH & ES) as the representative agency in charge of planning. This agency has in operation a "continuing areawide waste treatment planning process." The Water Quality Bureau of the DH & ES has designated the Flathead drainage as *water quality limited* through its continuing planning process.

The most recent amendments to the Montana Water Pollution Control Act, effective November 5, 1973 include a provision on nonpoint pollution sources (MAC 16-214(10)-S14480 Water Quality Standards):

> "Pollution resulting from storm drainage, storm sewer discharges, and *nonpoint sources*, including irrigation practices, road building, construction, logging practices, overgrazing and other practices, are to be eliminated or minimized as ordered by the Department."

This statement is preliminary to a program aimed at identifying and controlling these sources within the next two years.

Montana has passed legislation regarding both water and air pollution. The administration of these acts is the responsibility of the Department of Health and Environmental Science. Relationships between the State and Federal government in regard to water and air pollution legislation are close and follow the general policies of the Federal government vis-a-vis the states: "it is the policy of the Congress to recognize, preserve and protect the primary responsibilities and rights of the States to prevent, reduce and eliminate pollution and to plan the development and use (including restoration, preservation, and enhancement) of land and water resources..."

Montana's 1967 water pollution control act and later amendments seek to keep the Montana laws in compliance with Federal requirements. The State Water Pollution Control Council adopted the State's Water Quality Standards which included water quality criteria, water use classifications and policy statements in 1967. In 1971, The State Water Pollution Control Act was revised and the functions of the Council were turned over to the State Department of Health and Environmental Sciences. Further amendments were enacted by the 1973 legislature.

In Section 2 (c)(2) of the 1973 amendment the law states that, "in revising classification of standards or in adopting new classification or standards the board may not so formulate standards of water purity or classify any state water as to lower any water quality applicable to any state water below the level applicable under the classifications and standards adopted by the state water control council...of 1967." And

Section 2 (c)(3) clearly states an antidegradation policy when it says, "the board shall require that any state waters whose existing quality is better than the established standards as of the date on which such standards become effective be maintained at that high quality unless it has been affirmatively demonstrated to the board that a change is justifiable as a result of necessary economic or social development and will not preclude present and anticipated use of such water." It goes further in Section 2 (c)(4) to say that, "the board shall require any industrial, public or private project or development, which would constitute a new source of pollution or an increased source of pollution to high quality waters, referred to in (3) immediately above, to provide the degree of waste treatment necessary to maintain that existing high water quality."

The DH & ES is carrying out a number of studies including the quality of the inflow and outflow from Flathead Lake and is trying to identify pollution sources from urban areas, agricultural areas, and forests. It is cooperating closely with the Department of Natural Resources and the Fish and Game Department. A biologist from the Fish and Game Department is assigned to the DH & ES to assist in studies and pollution monitoring. In cooperation with EPA it sponsored a study recently completed by John Tibbs of the University of Montana.

Air Quality

The 1967 legislature passed the basic law entitled "The Clean Air Act of Montana" which set policy, responsibilities for administration in the DH & ES, created the Air Pollution Control Advisory Council and established its powers. The broad powers provided by the law, included making rules, identification of sources, power to enforce, undertaking studies, monitoring, and establishing standards.

The Board was also authorized to issue, suspend, revoke or renew permits, make inspections and has the power to shut down violating persons, or companies and issue penalities.

Municipalities and counties were authorized to establish local air pollution control programs and to administer them.

The local laws can be more strict than state laws but not less. If, however, the local program is not able or does not comply with set standards the state reserves the right to reassert control.

Ambient air quality standards were established on May 27, 1967, and recognized as only a beginning. "These standards are not intended to represent the ultimate in air quality achievement." The plan was to strengthen and improve them as research provided knowledge for sounder standards. The goal for air quality was established as a compromise. "The standards are designed to protect the health, welfare and comfort of the public and to minimize economic losses."

Regulation 90-1010 revised January 9, 1970 stipulates "Open Burning Restriction." Under Section A, Refuse Burning Restrictions, it states "NO person shall cause, suffer, allow or permit an open fire except under the conditions:

1. When such fire is set or permission for such fire is given in the performance of the official duty of a public officer, and in the opinion of the control officer is necessary:

a. for the purpose of the elimination of a fire hazard which cannot be abated by any other means.

b. for instruction in methods of fighting fires.

c. for the purpose of removing any hazardous material.

2. When such fire is set in the course of an essential agricultural operation in the growing of crops or in the course of accepted forestry practices provided no public nuisance is created and provided a permit has been secured from the control officer.

3. When fires are set for the clearing of lands for new roads under conditions stipulated in writing by the control officer and after having applied for and received a permit for such open fire from the control officer.

A study conducted by personnel of the DH & ES in the Flathead Valley area November, 1968 to August, 1970 (following an earlier base line study of the same area in 1963-64) observed that: "The air quality in Flathead Valley has shown an alarming decline during the past seven years." It concludes that the "most significant source of suspended particulates and dirt fall is...from dusty paved and unpaved streets and open burning." Among the recommendations made by the study team are: (Regulation 90-005)

"1. That dust depressants be applied to all unpaved city streets.

2. That all open burning be stopped...

3. That an alternative method to slash disposal by burning be found."

While regulation 90-010 makes an exception for the disposal of slash by burning, State and Federal forestry agencies have expressed the feeling that this exception is temporary and that the DH & ES may eventually prohibit the burning of slash or other uses of fire in forestry.

The Forestry agencies are experimenting with mechanical means to reduce slash in certain situations. They firmly believe, however, that fire has a role in the forest ecosystem not only for reducing the danger of wildfire and preparing seedbeds, but also for releasing certain soil nutrients. The Fish and Game Department (F & G) wants burning continued as a means of providing additional browse on game ranges.

At this time the forestry agencies have worked out an agreement with the air quality officials of the DH & ES aimed at minimizing environmental degradation from slash burning (see appendix).

The Montana Environmental Policy Act (MEPA) of 1971, established the basic policies and guidelines for environmental protection in Montana. Patterned after NEPA, it establishes the Environmental Quality Council and staff and establishes the duties and procedures for the director and staff.

MEPA requires the preparation of environmental impact statements:

> "Prior to any decisions concerning major action or recommendations or proposed legislation that significantly affects the environment, State agencies shall, in consultation with other appropriate agencies and individuals, both in the public and private sectors, assess in detail the potential environmental impact in order that adverse effects are avoided..."

The revised guidelines for environmental impact statements were adopted by the EQC on July 21, 1972.

The act pronounces that "it is the continuing responsibility of the State of Montana to use all practicable means, consistent with other essential considerations of state policy, to improve and coordinate State plans, functions, programs and resources..."

The Montana EQC has certain supervisory and coordinating responsibilities over State agencies. It orders all State agencies to "review their present statutory authority, administrative regulations, and current policies and procedures for the purpose of determining whether there are any deficiencies or inconsistencies therein which prohibit full compliance with the purposes and provisions of this act..." However, it specifies that statutory obligations shall be unimpaired by the act and that the policies set forth in this act are supplementary to those set forth in existing authorizations of all boards, commissions and agencies of the State.

The MEPA was established by the legislature and the Montana EQC is responsible to the legislative assembly, although the Governor is an ex officio member of the Council. The Director has the responsibility to gather information on environmental trends, review and appraise various State programs and activities, recommend policies to the Governor and legislature, conduct research and investigations, document and define changes in the environment, provide material and aid in preparing legislation, review and evaluate programs of other agencies and recommend improvement, and provide annually to the Governor and legislature a statement on the condition of the environmental quality of the State. This report shall evaluate the condition of the environment, its adequacy in meeting the State's needs, the current and foreseeable trend in environmental quality, the adequacy of the State's programs and recommendations for needed remedies. In this way, the EQC has a general oversight responsibility for all environmental programs in the State.

The Department of Natural Resources and Conservation (DNR & C) considers MEPA as the basic guideline for all its activities. The main emphasis is on timber sales from State forest lands including those in the Flathead area. An internal environmental statement is prepared on all timber sales and an Environmental Impact Statement is prepared for all sales determined as "major." The determination is made by the Director of DNR & C. These statements are sent to the EQC, the Governor and interested people. If water questions are involved in the sale, soils scientists, hydrologists and other specialists are available from their own staff as well as from other divisions for preparation of the impact statement. Fish and Game biologists are asked to participate in statement preparation on all sales except minor ones. This process slows down timber sale preparation and more lead time is needed but the general reaction of department personnel is to welcome the process. Excellent comments have been received from other agencies and from the public. The individual timber sale plans define specific policy and guidelines for each sale.

The DNR & C is cooperating with the Flathead County Planning Board in Land Use planning. The Forest Service is also cooperating with the Flathead County Planning Board and has made a significant contribution to it. It finances one professional land planner who serves on the County

Planning team. The arrangement is made under a cooperative agreement with the State. The DNR & C is also working with the Pacific Northwest River Basin Commission. The Flathead area has been selected as one of the study areas by the Commission but the study has been underway for only one year. The Geological Survey is now monitoring streams in the area for water quantity, the DNR & C would like to extend the monitoring to include water quality. The DNR & C has also tried to interest the Fish and Game Department and the DH & ES into a water quality monitoring program but only a limited amount is being done.

Environmental Analysis Reports are prepared where forest roads are built cooperatively with the Flathead National Forest or other groups such as the Burlington Northern Company which is a large private landowner in the area.

The Fish and Game Department's responsibilities in water quality stem primarily from the Stream Preservation Act which applies to any projects by any subdivision of State government which might alter a natural body of water, physically. Its main concern is with road and highway construction, it has no authority over irrigation diversions.

The department is involved in the State water pollution control act because the criteria established are largely biological. While the DH & ES has the responsibility under the act, the Fish and Game Department provides it with a fisheries biologist. Personnel of the F & G Department throughout the State serve as the ears and eyes for the DH & ES, reporting infractions that they learn about in the course of their work.

The department is also consulted by the State Forestry Division and by Federal agencies and is invited to review timber harvest and road construction plans and environmental impact statements, for example, the plan for Bunker Creek on the Flathead National Forest. This controversial sale is being criticized by citizens and much of the criticism comes to the F & G Department to act as intermediaries for the public in relations with the Forest Service.

The F & G Department has been responding to many proposed management plans on public lands. It has kept records of its comments in order to see what the agencies accepted and what they rejected. A staff member commented that the officials of the Flathead National Forest were the most responsive Forest Service administrators in accepting the comments and recommendations of the F & G Department.

In many of the mountain streams the critical wildlife is identified as the Native Cutthroat Trout which has very specific water quality requirements. The Fish and Game people, especially the fisheries biologists, are capable of identifying sedimentation problems and their possible extent. While the legal authority rests with the DH & ES, Fish and Game officials act when they consider it necessary. Apparently this working relationship causes no friction and is, in fact, a satisfactory relationship to both agencies. There is no monitoring of stream sediment content, identification now is by observation only. The impact of stream sediment, such as its effect on invertebrates, trout, and other species is not known.

Fish and Game officials expressed unhappiness with the condition of the valleys of the North Fork as the result of past logging. They also criticized road construction into unroaded areas.

The Fish and Game Department advocates slash burning and would like to see controlled burning in brush country. It expressed the belief that: "burning is essential for improvement of wildlife habitat."

Relationships between F & G and EQC are close. EQC staff calls on the F & G Department for review of highway plans and their possible effects on stream channels as well as for review of impact statements affecting hydraulics, game seasons, campgrounds, etc. F & G and EQC keep each other informed of their activities. On plant siting, the Bitterroot powerline and other proposals, F & G was called in to help the DNR & C with the preparation of impact statements. F & G in the past has formed the bulk of the critics in State government. It has now changed status to that of co-authors with DNR & C with EQC, and with DH & ES on impact statements, plans, etc.

F & G feels that it could close down a timber sale, either Federal or State as well as roads on a timber sale under the Stream Preservation Act. There is no question that it has the power to call for an alteration in plans for roads or timber sales. But the effect would have to be a physical alteration of the stream under the Act. However, as the eyes and ears of the DH & ES it could invoke the State water pollution act.
It has not yet invoked the non-degradation clauses of the State law. In fact, that clause has not yet been invoked by anyone but it does represent the ultimate power in the hands of State agencies.

In its unit planning activities the USFS leans on the F & G Department for specialists. But specific knowledge is not available on many factors such as the quantification of stream quality, and the effects on wildlife. The department can help in identifying winter range but a great deal is yet unknown of the relationships of forest harvest, and roads to the wildlife and fish. At this time the F & G Department feels that its contribution to planning is of minor value. The process of participation with the Forest Service shifts part of the responsibility to the F & G department and meets certain coordinating requirements. The department feels that it is sometimes used as a crutch for credibility. F & G data are not really useful for planning but more for setting seasons and identifying winter range.

Environmental Monitoring

In its second annual report issued in October 1973 the Montana Environmental Quality Council reviewed the environmental activities and accomplishments of Montana agencies and the legislature. It also listed new programs proposed by agencies. Among these the Council recommends the creation of an interagency environmental monitoring committee:

> "This recommendation involves creation of an interagency environmental monitoring committee that would standardize and coordinate federal and state monitoring. In effect, the committee would define parameters to be measured, standardize methods of observation, coordinate programs, provide data storage and dissemination systems, attempt to eliminate duplication of effort and unwanted ommissions, and coordinate with federal monitoring."

Such an action would be a big step toward the coordination of Federal and State activities specified in the Federal Water Pollution Control Act

Amendments of 1972 and would also provide for closer cooperation called for in the National Environmental Protection Act of 1969 and the Clean Air Act. It could also help to set the stage for working out control and enforcement procedures, training programs, demonstrations and other procedures needed to meet the environmental goals expressed in the Acts.

State Agencies in Summary

The State has relatively strong policies and laws protecting environmental quality. It has developed workable guidelines and excellent working relationships among the State agencies involved in environmental protection. The coordination of activities among State agencies provides a strength and effectiveness which is better in many ways than strict departmental responsibility and authority.

The relationship between state and federal agencies, however, is not well developed. Points of contact have occurred as past programs have brought state and federal agencies together, but there is as yet no coordinated approach such as will be required for "areawide waste treatment management planning" under the Federal Water Pollution Control Act Amendments of 1972. Some cooperation in water quality studies exists. For example, the DH & ES is making some water analyses for the Beaverhead and Gallatin National Forests now, but this is not part of a deliberately planned program.

Several state agencies have initiated monitoring programs around the state including some in the Flathead River basin. These appear to be largely uncoordinated with the monitoring being done by some federal agencies. However, the EQC has proposed a coordinated monitoring program which could become a first step toward the coordination of state and federal water quality programs into areawide waste treatment management planning.

The Flathead River Basin has become the center of concern of a number of state and federal agencies. While the focus is on Flathead Lake, the concern is for the whole basin. With the example of Lake Tahoe in mind state agencies and local residents realize that degradation of water quality is already taking place and that prompt, major and continuing action is necessary to restore lost quality and prevent further deterioration. The efforts of every agency involved in the Flathead Basin are needed in a continuing, cooperative program to identify, monitor and control the sources of pollution throughout the basin.

The state resource management agencies are in need of more knowledge and data to identify and quantify the environmental effects of their activities as well as those other activities affecting the quality of air and water. The present level of monitoring is not sufficiently advanced to provide the data for identification and control of nonpoint sources of pollution. The monitoring of the DH & ES has been directed toward point sources of pollution. The F & G Department has been observing sedimentation from nonpoint sources and its effect on the fishery resource but it has not been monitoring or quantifying the amounts or effects.

The Division of Forestry in the DNR & C has not been monitoring for the effects of forestry activities on state lands. It does not have data on the effects of its activities on water or air quality and it has developed no means of predicting the environmental effects of forestry practices. While it prepares environmental statements on planned activities, and while it observes the traditional precautions in road construction and timber harvest it has not accumulated the quantified data needed to provide precision in predicting environmental effects. Its policies and guidelines are now in compliance with NEPA but do not yet meet the requirements under the most recent revisions of the Water Pollution Control Act regarding nonpoint pollution.

II. POLICIES AND GUIDELINES OF THE U.S.FOREST SERVICE REGARDING AIR AND WATER POLLUTION

A. Washington Office and Regional Office Policy Guidelines

Air and water pollution, from nonpoint sources of forest management practices, are a direct consequence of the magnitude and character of soil and vegetative disturbances occasioned by the management program. For a given "magnitude" of management, pollution rises with decreased care and concern for environmental quality; for a given "character" of management, pollution rises with increasing quantities of timber cut, roads constructed, and acres of slash burned.

The Forest Service has responded to Federal and State environmental quality actions with three distinct and separate sequences of policy development of its own.

One sequence we will call the "Environmental Quality Sequence." It begins with the NEPA Policy, and it develops the Forest Service's procedures for meeting the provisions of the law. This sequence deals with the character of forest management.

So does another, that we will call the "Forest Management Practice Sequence," but it also confronts the question, ultimately, of the magnitude of management activities. This line of policy development is a direct response to the political issue of forest management practices--notably clearcutting--that surfaced in 1970 and was punctuated recently by Judge Maxwell's decision that clearcutting, specifically on the Monongehela National Forest is illegal. By no means, of course, is this sequence of policy development concluded, but it bears directly on air and water pollution.

The third sequence also is concerned with the character of forest management and the magnitude as well, but in a broadly generalized way. We will call this sequence by the name of its seminal document, "The Framework for the Future Sequence." It is a policy "charter" that came from the Chief's office in February of 1970, apparently a consequence of the public concern for environmental quality that produced, in the legislative branch, the National Environmental Protection Act. The "Framework for the Future" document outlines the broad objectives the agency intends to pursue and is amplified by refinements at the regional and forest levels.

These three sequences began and progressed independently of one another; documents in one sequence related only to other documents in that sequence, and there was no visible integration until two of the sequences were deliberately joined. Nevertheless, there are at least some elements that are common to all three sequences: the language is strongly influenced by a concern for environmental quality; the autonomy of the National Forest unit as an independent planning entity is either assumed or directed; there is a strong "people orientation" in the sequence--forest management is to be pursued to meet the needs of people; and a great deal of stress is placed on inclusion: all the resources and values are to be considered in virtually any activity--planning, project work, and budgeting. Finally, perhaps, there is a common failing, too: "quality environment" is assumed to be an identifiable and agreed-upon objective, but it is never well described or defined because the attempt to do so is never made.

The Environmental Quality Sequence

The Forest Service sees NEPA as a basic component of its legal foundation. It sees three other laws, in particular, in a similar light: the Wild and Scenic Rivers Act, P.L. 90-542, of October 2, 1968; the Wilderness Act, P.L. 88-577, of September 3, 1964; and the Multiple Use Sustained Yield Act, P.L. 86-517, of June 12, 1960.

The first policy response the agency made to NEPA was "Emergency Directive No. 1," issued July 13, 1971. It established a new title in the Forest Service Manual, Title 1900--Environmental Planning and Management. The emergency directive established Chapter 1940, Environmental Statements. The chapter listed four main subheads as follows:

1941 ACTIONS REQUIRING ENVIRONMENTAL STATEMENTS
1942 ENVIRONMENTAL STATEMENT PREPARATION
1943 CONSULTATION AND REVIEW PROCESS FOR FOREST SERVICE ENVIRONMENTAL STATEMENTS
1944 FOREST SERVICE REVIEW AND COMMENT ON OTHER AGENCY STATEMENTS

On November 29, 1971, Region I issued an Emergency Directive elaborating the Washington directive for local circumstances. Forest Supervisors were to prepare Statements, and they would be processed through the Multiple Use Group in the Regional Office. Ultimately, the statements would go to Deputy Chief for Programs and Legislation. On November 9, 1971, the Washington Office issued another Emergency Directive, this time under the 2100 title, Multiple Use Management.

> The planning policy, standards, and procedure contained herein are responsive to the Act of June 4, 1897, the National Environmental Policy Act, the Multiple Use-Sustained Yield Act and other national direction.

> A major effort has been made to merge the requirements of the National Environmental Policy Act and the past practices that have been developed for multiple use management. A basic framework that facilitates this merger is provided in Chapter 2130.

Thus the agency decided early to integrate environmental quality consideration with its multiple use planning efforts. There is a question, of how direct the relationship is between multiple use planning and the management practices that show up in the woods; but the agency was determined to take the NEPA seriously.

Emergency Directive No. 1, November 9, 1971, constituted a chapter of the Forest Service Manual that listed procedures for Multiple Use Planning. There were five subheadings:

2110	Planning Standards
2120	Planning Procedures
2130	Environmental Analysis
2140	Environmental Statements
2150	Coordinating Instructions

Chapter 2130 was to provide the basic framework for "the merger," and this is the language that did it:

> An environmental analysis and its documenting report will be made for all resource uses and activities and plans concerning or involving National Forest System lands. The analysis will be the basis for reaching decisions or making recommendations on programs and activities. Programs and project plans and their implementation will be developed and carried out in accordance with the decisions reached in the environmental analysis process and as documented in the Environmental Analysis Report...
>
> Objective: The environmental analysis and report system is intended to provide, as an every day standard of doing business, a working, planning, and decision making process that is responsive to both the Multiple Use-Sustained Yield Act and the National Environmental Policy Act...

On March 8, 1972 the Regional Office issued its supplementary instruction to comply with the Washington Emergency Directive. Environmental analyses and reports would be an integral part of the multiple use planning system, and would serve a number of purposes (Ref. ED No. 1, 3/8/72, p. 2130.2--1): they would show the consequences of a proposal, project, or planning unit, in terms of irreversible and irretrievable commitments of resources; they would provide a systematic means for meeting the requirements of NEPA for submitting statements; and they would provide an objective basis for evaluation of the project by interested publics.

This Regional Directive also specified that Environmental Analyses and Reports would be prepared by Forest Supervisors and if subject to Regional Forester approval submitted to the Area Studies Group in the Multiple Use Coordination branch of the Regional Office for review.

In May of 1973 the Washington Office issued Title 8400--"Environmental Statements." This was essentially a number-change, superceding the older Title 1900 which had been entitled "Environmental Planning and Management." The subheadings were the same, and the thrust of the title was the "how-to" information on the preparation and submission of environmental statements.

The net of all this seems to be as follows: in all multiple use planning activities, environmental analyses and reports will be made, according to the policy guidelines in Title 2100 of the Forest Service Manual. In those cases where an environmental statement is to be submitted to CEQ, the procedures of Title 8400 will be followed.

There is, in this "Environmental Quality Sequence," however, neither standards specified for air and water pollution control, nor reference to such activities. There is a vague but palpable urge to consider environmental effect in planning activities, but no attempt made to define pollutants, or even to identify them.

The Framework For The Future Sequence

This sequence of environmental policy development begins in February of 1970 with a document entitled, "Framework for the Future." This document is seen by field people as a landmark, and it lists a series of "objectives" and subsumed "policies" to achieve them. These are the "objectives":

> Promote and achieve a pattern of natural resource uses that will best meet the needs of people now and in the future.
>
> Protect and improve the quality of air, water, soil and natural beauty.
>
> Help protect and improve the quality of open space environment in urban and community areas.
>
> Generate forestry opportunities to accelerate rural community growth.
>
> Encourage the growth and development of forestry based enterprises that readily respond to consumer's changing needs.
>
> Seek optimum forest land ownership patterns.
>
> Improve the welfare of underprivileged members of society.
>
> Involve the public in forestry policy and program formulation.
>
> Encourage the development of forestry throughout the world.
>
> Expand public understanding of environmental conservation.
>
> Develop and make available a firm scientific base for the advancement of forestry.

This was issued from the Washington Office, over the signatures of Secretary Hardin and Chief Cliff. It was followed in March of 1972 with a Regional refinement entitled, "Management Direction for Northern Region."

This document was keyed directly to the "Framework," policy by policy and objective by objective, and relied exclusively on such verb-forms as, "encourage employees to participate," "become actively involved," make resources available," "offer the use of skills," "expand plans," "provide leadership," etc., etc. Both documents might be summarized this way; "Do right things and do things right."

In November 1972 the Region issued a "Northern Region Program Emphasis," another document in this sequence. "Program Emphasis" was divided into three categories. The first was "Regain our Professional Credibility With the Public," and these were the items catalogued thereunder:

Accelerate and Intensify Multiple Use Planning
Balance Programs Within the Region
Improve the Quality of Our Timber Harvest Activities
Improve the Quality of Our Road Programs
Provide Leadership in the Entire Environmental Field
Become Intimately Familiar with the New Wilderness
  Area Program so we can Work Effectively with the
  Public

The second category of emphasis was, "Raise Our Standards..." and the third was, "Improve Trust and Confidence...Within Our Organization..." At the end of this document is a listing of "High Priority Items for FY 1974" and they include such things as, "maintain Commitment to High Quality Environment" and "Restore Pride in Workmanship."

The "Framework for the Future Sequence" of policy development extended ultimately to the Flathead National Forest; the policies and objectives of the "Framework" document itself were incorporated directly into the Forest draft multiple use plan, and presumably the Flathead people took seriously the exhortations of the "program emphasis" paper to "regain credibility," to "raise standards," and to "improve trust and confidence."

There is much in the "Framework for the Future Sequence" to provoke skepticism. The agency simply cannot, for example, "provide leadership in the entire environmental field" by proclaiming its desire to do so, no matter how sincere and unanimous the proclamation.

And yet it was clear that the expressions of good intentions produced palpable results among the people on the Flathead National Forest. External observers, might choose to see the platitudes as a smokescreen for conducting business as usual; but the Flathead people took them seriously, as honest commitments from Washington and the Regional Office to improve the environmental consequences of forest management. The study will explore their behavior in more detail later.

The Forest Management Practices Sequence

This line of policy development is directed and specific. It probably represents the policy area in which the greatest political and public activities have taken place. The agency has hammered out a policy development sequence here in direct interaction with the political processes. This sequence began in the turbulent year of 1970, when forest management practices constituted a hot, lively, and controversial public issue.

The initial and influential publication in this series was "National Forest Management in a Quality Environment--Timber productivity" which appeared March 26, 1971. It was the result of a Washington Office study team composed of the following people:

Homer Hixon, Director, Timber Management
T. B. Glazebrook, Director, Watershed Management
Carl Ostrom, Director, Timber Management Research
Donald D. Strode, Assistant Director, Wildlife Management
Edward H. Stone II, Landscape architect, Division of Recreation

The study relied upon, and reviewed, a number of prior studies: "Management Practices on the Bitterroot National Forest," by a Task Force team in Region I; "EvenAged Management on the Monongahela National Forest"; the August 1, 1970 report of the West Virginia Legislature; and "Report on the Bitterroot National Forest," by a Select Committee of the Univeristy of Montana.

This, in outline form, is what the "Timber Productivity" study had to say:

A. Introduction

   1. The National Forest System--a brief description of the size and operation

   2. The Nation's Wood Needs--for improved housing, and the importance of timber harvesting to the national economy

   3. Actions Now Underway--broader, multidisciplinary, public-involvement planning systems are being developed; reorganization into multidiscipline-team management instead of functional management; effort to incorporate environmental concerns--for example, timber management "needs to be 'designed' to enhance multiple use rather than to be 'modified' for that purpose in the past."

B. Background

   1. Harvesting practices--the standard definitions: clearcutting, shelterwood, seed tree, selection, intermediate, and salvage cuttings.

   2. Regeneration and stand improvement: a plea here for more money to reduce the backlog of needed work.

C. Problem Situations and Responses (30 problems identified in all)

1. Problems of aesthetics: sensitize the FS to aesthetics--recognize areas where timber will not be harvested because of the lack of suitable alternatives to clearcutting, and environmental impacts make clearcutting unacceptable--

2. Problems of silvicultural practices and regeneration--recognize and avoid problems of regeneration and final harvest cuts--a finely detailed section here, referring to specific timber types. e.g., problem 15: "to carefully review environmental protection aspect of each major type conversion project before such projects are undertaken."

3. Problems of resource data, planning, and administration. Problem 17: "To develop and put into effect an adequate system to collect information on land-use capability and suitability that will identify the land base available for sustained yield timber production and will exclude from the allowable cut base those areas that cannot be harvested within acceptable environmental quality standards by using foreseeable technology." (This planned program would certainly have a significant impact on pollution levels because it would alter the magnitude of forest management activities: indeed, if it was fully implemented it would determine the pollution-component attributable to the magnitude of activities; henceforth, only the character of those activities would influence pollution loads.)

4. Problems of Road Systems--phasing out jammer logging to reduce road-frequency.

5. Problems of research needs; problem 30--to accelerate research in three program areas.

    a. Understanding the forest as an environmental and productive base.
    b. Understanding human interactions with the forest environment.
    c. Development of timber-management practices that enhance or have minimum impact on the environment and are compatible with other forest uses.

A condensed and popularized version of this paper was published in May of 1971, entitled, "Timber Management for a Quality Environment."

In July, 1972, a derivative publication appeared, under the signature of Chief McGuire. This was called, "National Forests in a Quality Environment--Action Plan," and it was prepared by a Washington Office Task Force in direct response to the 30 problems outlined in "Timber Productivity." There appeared to be a great amount of field interaction in preparing the paper, and in his covering memo, Chief McGuire quotes verbatim from "Clearcutting on Federal Lands," the March, 1972, report of the Senate Subcommittee on Public Lands. McGuire's quotes relate largely to the "guidelines" in the Subcommittee report:

1. Allowable harvest levels--these should not be raised until management practices justifying the raise are proven effective and funded.
2. Harvesting limitations--clearcutting is not to be used on unstable sites, where restocking is uncertain, where aesthetic considerations dominate, and in situations where only economy of operations is served.
3. Clearcutting should be used only where it is silviculturally essential, where blocks can be kept small, and where "a multidisciplinary review has first been made of the potential environmental, biological, aesthetic, engineering, and economic impacts on each sale area."
4. Timber sale contracts should contain requirements to avoid or minimize environmental impacts of timber harvesting, even if

such measures result in lower net returns to the Treasury.

The Chief, in his memo, responds to each of the Subcommittee Guidelines by outlining planned actions called for by the 30 problems in the "Timber Productivity" paper. These planned actions, in turn, constitute the bulk of the Action Plan, and take the form of suggested training programs, planning programs, and reissuing and/or modifying sections of the Forest Service Manual and other directives. There are many followup reports called for in the action plan, due in Washington January 31, 1973, July 1, 1973, and January 31, 1974.

Region I responded to the Washington Office "Action Plan" by issuing one of its own, entitled, "National Forest in a Quality Environment--Northern Region--Action Plan." This appeared November 11, 1972, signed by Regional Forester, Steve Yurich. This also derives directly from the March 26, 1971 report, "National Forest Management in a Quality Environment--Timber Productivity"; it lists the same 30 problems, the actions called for both by the Washington Office Action Plan (including specifically the ones that relate directly to the Subcommittee Guidelines), assigns responsibility for completion to the various units, specifies completion dates, and calls for progress reports on specified dates.

B. Policy Development On The Flathead National Forest

Three sequences of policy development in the Washington and Regional Offices have been traced, all of which were responding to the environmental concerns of the 1970's.

The "Environmental Quality Sequence" of policy development deals with the mechanics of implementing NEPA, and it outlines the procedures for making environmental impact reports and statements. The "Framework for the Future Sequence" relates to broad objectives and states firmly, although vaguely, the agency's commitment to doing right things and doing things right. And the "Forest Management Practices Sequence" deals almost exclusively with clearcutting, allowable cut levels, and other matters dealing with timber management.

It would be expected that the three lines of policy development would converge on the Flathead National Forest, and to a degree they do.

The requisites of NEPA, absorbed by Washington directive into the multiple use planning procedures, appear at the Forest level well integrated in the planning process, which is also heavily influenced by the "Framework for the Future Sequence." NEPA and the Chief's "Framework for the Future' document are highly visible in the Flathead's multiple use planning activities.

The end of the chain of the "Forest Management Practices Sequence," however, is less obvious. The Region prepared a document entitled, "National Forests in a Quality Environment--Northern Region--Action Plan," outlining 30 tasks to be completed which would improve the environment quality consequences of timber harvesting. It has been distributed to the National Forests and to ranger districts. Last summer it was the basis of supervisor inspection of at least two ranger districts on the Flathead Forest to check compliance.

And those outcomes will indeed be significant at the Forest level. Problem No. 2, for example, reads as follows:

> To recognize those areas where timber will not be harvested because there is no suitable alternative to clearcutting and environmental impacts make clearcutting unacceptable.

One of the actions called for to solve this problem is, "identifying such areas on the ground," and the responsibility for its accomplishment is assigned to the Regional Office Divisons of Timber Management and Soil and Water Management, and to the Intermountain Forest and Range Experiment Station. This job was scheduled for completion June 30, 1973. The Flathead Forest, however, had not received an inventory from the Regional Office of such sensitive areas. Problem No. 4 is particularly acute on the Flathead:

> To recognize those areas where the final harvest cut must be discontinued or deferred because there is not assurance that the area can be suitably restocked within 5 years after logging.

Such areas were observed in field inspections, particularly in the spruce-salvage areas, some of which were twenty years old and had not restocked. The action called for here is to "Identify the problem areas on the ground and withdraw (these areas) from the allowable cut (standard) base," and once again the responsibility was assigned to the RO Division of Timber Management. This task was to be completed by December 31, 1973.

The process as prescribed could not operate satisfactorily because the Regional Office was not able to provide the specific recommendations needed. The Regional Office did develop the criteria which served as guides and the specifics were worked out by the Flathead staff. They have incorporated these into their planning process and into specific recommendations in the field activities.

The silviculturist, for example, examines the soils, the timber stand and land forms for a specific sale to decide whether or not clearcutting is suitable or whether an alternative system is preferrable.

The Land Use Plan identified the high area zone as a problem area where there was no assurance of restocking in 5 years and withdrew if from the allowable cut base. It has identified other areas where regeneration is a problem and is negotiating with the Regional Office to withdraw these from the allowable cut base. The other two sequences, however--embodied in NEPA and the Chief's "Framework for the Future"--are apparent on the Flathead in the multiple use planning activities.

It is through these planning efforts that policy developments continue at the National Forest level, and the attitudes and opinions of the planners are probably paramount in the policy outcomes.

The "Environmental Quality Sequence" and the "Framework for the Future Sequence" have both been very influential in the thinking of the Flathead personnel--the Supervisor and his top staff people. The two sequences emphasize that more decisions will be made "closer to the ground," and improving the quality of the physical environment will weigh much more heavily in those decisions. Also improving the physical environment will involve improving the character of forest management activities, and it may also involve decreasing the magnitude of those activities; e.g., "spot" scarification instead of complete scarification of seed beds. Many of the suggestions in the policy sequences would create a negative impact on the allowable annual cut, and the Flathead planners understood the implications of these suggestions.

The Washington and Regional Office policies and guidelines are translated to the Flathead National Forest in various ways. The planning process makes these policies and guidelines specific for the Flathead.

The plans of the Flathead are and will be the policy of the Flathead, and those plans are intended to be interlocked into a hierarchy.

The fundamental process is multiple use planning. In this planning process and through this planning staff the administrative requirements of NEPA are met: environmental analysis reports and, if a project is of sufficient importance to warrant one, environmental impact statements are written with the multiple use plan as "constraint" and are reviewed by the multiple use planning staff.

The multiple use plan--the document--currently in effect on the Flathead is called the Flathead National Forest Basic Land Management Plan; it was recommended by Supervisor Corpe on December 23, 1971, and approved by Regional Forester Yurich November 1, 1972. A revision was approved in February, 1974. This is the foundation of the hierarchy of plans on the Flathead, and it contains four major sections, three of them unique to the Flathead. The first is a description of forest zones that is virtually identical to that for other national forests; but the "forest situation," the "forest basic assumptions," and the "forest coordinating requirements" are unique to the Flathead.

The concept of forest zones is being discarded in the Land Use Plan in favor of a system to identify discreet areas of land requiring special management considerations. For example, the high area zone is distinguished by biological limitations which may have some uniformity. The limitations on the special zone, however, are cultural and the treatment of each may be different. Whatever was not classified into other zones became the General Forest Zone and it was unheterogeneous and had to be reclassified for management purposes.

The heart of the plan lies in the coordinating requirement (CR's). These "CR's" were hammered out in hours of staff negotiations. The staff including the rangers are strongly committed to them. In general, they are policy statements for the resolution of decision problems, and they were designed to accord the promises of the policy sequences from the Washington and Regional Offices. They will be examined in detail later in the report. They assert that decisions will initiate on the Flathead and that environmental quality will be the overriding criterion.

The plan, then, is a comprehensive policy statement. The biological data that will eventually rationalize production goals will be generated in the next level of the planning hierarchy. "Unit plans" will be developed containing detailed biological analyses of various geographical subdivisions of the Flathead. One of these unit plans for the Spotted Bear River Unit, has been completed. Others are underway; they are detailed identifications of "E.L.U.'s," ecological land units, and are based on a system of "habitat typing." These will be examined in more detail later.

The next step in the planning hierarchy is the preparation of "functional plans," for the production of timber, recreation, water, wildlife, and forage resources. Ultimately, these functional plans will be built on biological data developed in the area plans, and one of these--a timber management plan--is to be undertaken in the immediate future.

Finally, at the bottom of the planning hierarchy, are the project plans--detailed prescriptions for timber sales, road construction projects, wildlife habitat management projects, etc.

The project plans are to be derived from the functional plans, which will be constrained by biological parameters in the unit plans, and all of them are to be guided by the multiple use plan: such is the nature and scope of planning--i.e., policy development--on the Flathead.

This is a description of the ideal, and the Flathead staff welcomes the opportunity. They would be delighted to stop all activities on their forest until their plans were in good order. But they are realists in at least two ways: they know that production and management activities, based on obsolescent plans and planning mechanisms, will and must continue; and they know that planning is a process and not an event. They see none of their plans as final, complete, and immortal. They are committed to the process of planning as the prelude to management.

C. Analysis of Adequacy of Forest Service Policy and Its Relationship to State and National Environmental Policy

The policy description in these pages leads to a single and conspicuous conclusion: the goal of the Forest Service is land management and resource production control and abatement of pollution has been reviewed as a constraint on these activities.

The agency has viewed NEPA as an alteration in its operational environment. It has seen such legislation as constraints, rather than a new set of objectives.

There is little question that the agency's management practices have contributed to air and water pollution. With one exception Forest Service policy fails to confront the necessity for pollution control.

The single exception is in the form of several "interim handbooks," highly specialized documents written for and by Forest Service hydrologists. The "Interim Handbook on Federal and State Laws, Executive Orders, and Rules and Regulations Pertaining to Water Quality in Region 1," is a compendium, without internal interpretation or subsequent policy refinement, and it does not include the stringent 1972 amendments to the Water Pollution Control Act. A document that explicitly spells out the Forest Service responsibility is the "Interim Guide for Water Quality Surveys in Region 1." It is in the process of revision to accommodate the 1972 amendments, but in restricting its emphasis to quality surveys, the document is a long way from dealing with the character and magnitude of forestry operations that determine pollution loads.

In respect to policy there is a need to distinguish cases. The package of policy for "environmental quality" as a concern, for drawing attention to the environment as a consideration, appears adequate. The package of policy for air and water pollution control, on the other hand, has not yet appeared.

The U. S. Forest Service is one of the oldest line agencies in the Federal executive branch. It has been in business for about 70 years. This longevity provides a set of preconditions against which policy changes must take place. Many of the preconditions are legislative. Many are derived from intraagency policy. Many are assumptions and behavior patterns of the several professions or "occupational specialisms" represented in the Forest Service. Some may be considered as the momentum of tradition.

Such momentum is not to be taken lightly in a 70 year old agency. It provides the Forest Service with an identifiable organizational self-image. The Forest Service people interviewed saw themselves as pre-eminently concerned with air and water quality -- the current way of saying "conservation." The tradition of good husbandry of the land was strongly felt, though rarely articulated. Concern for air and water quality was taken as axiomatic. This concern was basic and fundamental in the policy and guideline documents inspected.

The Environmental Protection Agency, on the other hand, neither enjoys nor is burdened by such preconditons of cumulative legislation, internal policy, professional predisposition, nor long tradition. Instead, it is driven by the zeal and enthusiasm of a sharply defined and strongly felt mission: the unequivocal and pinpoint-focus on air and water quality.

The mission of the Environmental Protection Agency is the control abatement and prevention of air and water pollution; but, that is not the mission of the Forest Service. The distinction is important to make, in order to understand the policy review undertaken. The Forest Service sees its mission as something rather distinct from and substantially more complex than the prevention of pollution.

The Forest Service sees its significant base of legislative policy as composed of four laws: the Multiple Use Sustained Yield Act of 1960; the National Wilderness Preservation Act of 1964; the Wild and Scenic Rivers Act of 1968; and the National Environmental Policy Act of 1969. On this legislative basis, internal policy is built.

In 1971, apparently in direct response to NEPA, the Washington Office issued a new title in the Forest Service Manual, Title 1900--Environmental

Planning and Management. In May of 1973 this was superseded by Title 8400, Environmental Statements; the content of this section of the Manual outlines the policies and procedures of complying with NEPA--when and under what conditions environmental impact statements must be filed, how many copies to prepare, where to route them, and the proper means of typing up a title page. The title deals specifically with the mechanics of meeting the requirements of the NEPA, not with air and water pollution.

Title 2100 in the Manual is entitled "Multiple Use Management," and it dates from 1960 when the Multiple Use Sustained Yield Act was passed. This title refined the legislation into agency procedures, but it is more comprehensive than that. The title establishes a resource planning procedure that the Forest Service is deeply committed to. The Multiple Use Act called for no such planning activity. Title 2100 defines the shape and substance of future resource management on the national forests. It also promotes a view of management, a philosophy of planning, and set of assumptions that go far beyond the simple mechanics of multiple use land-zoning and implementation. In an "Emergency Directive" dated November 1, 1971 Title 2100 is seen in its central and controlling role. On that date NEPA was absorbed into multiple use planning activities. This is the language from that Directive:

> A major effort has been made to merge the requirements of the National Environmental Policy Act and the past practices that have been developed for multiple use management.

Thus NEPA was absorbed. The Forest Service has been in the conservation business for a good many years and the agency believes that making some adjustments in its planning and reporting procedures would adequately meet the requirements of the law.

The "Flathead National Forest Basic Land Management Plan" approved by the Regional Forester on November 11, 1972, is loaded with stated concern for environmental quality, and the coordinating requirements, it might fairly be said, are directed at little else.

"Unit plans" are to be developed on the basis of the basic multiple use plan. One such plan has been completed--the one for the Spotted Bear Planning Unit. This plan, too, is full of environmental quality language, reflecting once again the spirit of NEPA.

According to FSM 2100, Environmental Analyses and Reports (EAR) will be prepared for each project the Forest undertakes. The Flathead Forest does so for each timber sale and road construction project. When the impact of a project is judged to be "significant," based on the EAR, an Environmental Impact Statement (EIS) is prepared.

A draft EIS has recently been issued on the Flathead for an interim revision of the timber management plan for the forest. Again, NEPA is respected in the planning process.

The documents and written guidelines relating to environmental quality, and the requirements of NEPA, are numerous. They relate almost exclusively, however, to the planning process, and only distantly if at all to Forest Service operations; and "policy" is accounted for only partially in documents and written guidelines.

"Policy" might also be construed to be what administrators do, in addition to what administrators say.

The Flathead National Forest is doing three things. The administrators are (1) planning, and in so doing are invoking the language and the spirt of NEPA.

They are also (2) cutting down trees and (3) building roads. The language and spirit of NEPA are conspicuous in these activities only by the frequently stated concern for "environmental quality" in Environmental Analysis Reports. The objective pursued is not air and water pollution control. The objective is forest land management.

In summary, the policy reviewed showed this: In written policy, a great concern is evident for "environmental quality," though the term is never defined in tangible terms. For air and water pollution control, there is as yet little written policy.

III. ACTIVITIES ON THE FLATHEAD NATIONAL FOREST AND THEIR RELATION TO AIR AND WATER POLLUTION CONTROL POLICIES AND GUIDELINES

The response of the Forest Service staff on the Flathead National Forest to the policies and guidelines from the Washington and regional offices has been direct and significant. The environmental concerns expressed have been taken to heart and converted to action on the ground. A new spirit pervades the staff. Their new, planned environmental approach to forest management is a considerable break with the past.

They have come a long way but there is still more to be done in order to meet the goals and criteria established by the Water Pollution Control Amendments of 1972 and the new NEPA Guidelines. These will be discussed in detail later. First what the Flathead staff have done in field operations since 1971 will be reviewed. It is significant and needs to be thoroughly understood so that the appropriate steps can be recommended to meet the new program requirements.

Perhaps the best way to understand the progress is to review the process of change which has been initiated in 1971 and follow it through to the present. The present operation will then be analyzed to identify program needs to meet the new requirements and from that analysis draw recommendations.

Operations in the two decades before 1971 will be reviewed to more fully appreciate what has been done since then. The history of forest harvest on the Flathead N.F. has set patterns which are very difficult to change.

A. Timber Operations on the Flathead N.F. Before 1971

Timber was the first major industry in the Flathead Valley. It started with the construction of the Great Northern Railroad which was completed in 1891. The industry began to export to national markets on the newly completed railroad. Building materials were shipped to settlers moving into the western great plains. Eastern Montana, western Dakotas and the adjacent Canadian provinces were teeming with new settlers and they provided a ready market for Flathead timber during the first two decades of 1900. Timber was also shipped to Butte for use in the mines. The supply of timber came mostly from the lower valleys: the Stillwater, Whitefish and Swan Valleys as well as the broad Flathead Valley itself. The timbering came almost to a standstill during the depression periods when markets disappeared and by that time the supply in the valley bottoms had largely been exhausted. The great boom period for the Flathead Timber industry has come since World War II. The sale of timber from the national forest had increased slowly from the depression period when almost no timber was sold until 3 to 4 million feet were sold annually. There was doubt that the annual allowable cut of 40 million board feet would ever be sold.

The war period brought a quick increase in production to 31 million feet in 1944. Production declined in 1946 and might have dropped further, but in 1947 work began on Hungry Horse Dam on the south fork of the Flathead. Timber on the reservoir site was offered for sale at prices which attracted local as well as distant companies. One of the latter moved in from Minnesota and set up a mill at Columbia Falls. Eighty-five

TIMBER VOLUMES CUT & SOLD - FLATHEAD NATIONAL FOREST

Data from U.S. Forest Service, Missoula, Montana 12/28/73
(in thousand board feet) (MBF)

Fiscal Year	Cut MBF	Sold MBF	Annual Allowable Cut (AAC)MBF	Cut in % of AAC
1973	118,364	120,248	156,000	76
1972	156,425	131,921	156,000	100
1971	149,060	153,818	194,500	77
1970	145,855	231,680	194,500	75
1969	167,780	150,527	137,500	122
1968	156,161	147,497	137,500	114
1967	138,572	141,702	137,500	101
1966	167,644	138,406	137,500	122
1965	145,533	134,198	137,500	106
1964	135,147	135,053	137,500	98
1963	146,305	146,135	137,500	106
1962	126,697	137,115	137,500	92
1961	108,879	131,123	137,500	79
1960	98,707	144,421	40,000	247
1959	88,490	112,001	40,000	221
1958	92,423	90,145	40,000	231
1957	79,989	55,304	40,000	200
1956	93,689	39,536	40,000	234
1955	102,537	129,717	40,000	256
1954	72,812	83,424	40,000	182
1953	65,658	82,648	40,000	164
1952	38,688	23,986	40,000	97
1951	19,080	72,785	40,000	48
1950	13,148	17,558	40,000	33
1949	Not available			
Calendar Year				
1948	32,407		40,000	81
1947	54,239		40,000	136
1946	32,834		40,000	82
1945	20,613		40,000	52
1944	22,668		40,000	57
1943	15,175		40,000	38

million feet of timber were sold in 1947 and 24 million the following year. This timber entered the market during 1947 to 1949. There was another reduction in 1950, but by this time the post-war building boom was well underway and demand for Flathead lumber spurted to an all time high. Total cut for the valley reached 200 million feet and from the national forest it reached 102 million feet in 1955. The spruce salvage program came as a boost to the industry just when it was declining after the Hungry Horse project. This stage seemed to have put it into orbit.

Spruce had not been a high demand item. After a small flurry of demand during World War I interest in spruce had died. Spruce on a low market was commanding only limited prices, now it was pushed as a new product competing with white pine. It also made a desirable material for "decking" and "knotty pine" paneling. At the first sale for dead spruce on the North Fork of the Flathead River the sale was limited to a few large operators because of the size of the operation and the expense of development. The spruce salvage program was a response to a natural catastrophe, but was possible because the means had been developed to harvest timber on steep slopes and the market was high enough to accept the timber at a profitable price. In 1949 hurricane winds struck this part of Montana and in this national forest completely leveled considerable areas of timber and uprooted many other trees throughout the area. Most of the damage occurred in spruce stands at higher elevations. The spruce beetle attacked the down and dying trees, rapidly building up in numbers and by 1952 the attack reached epidemic proportions and had spread into green timber. Millions of board feet of spruce timber were killed and a salvage program was launched. It was estimated that more than 2.5 billion board feet of spruce timber were killed in Montana and Idaho. Removal of spruce timber soon after mortality is urgent because the wood deteriorates rapidly and is suitable for lumber for only about two years after it dies. The beetle epidemic declined by 1957. The salvage program brought prompt government action. Roads were built into the high country to salvage the spruce, a system of clearcutting was developed, there was an expansion in Forest Service activities aimed at the salvage of the dead spruce, the industry expanded and there was a considerable immigration of new industries into the area.

The movement of timber harvesting into the steep lands and high country would have proceeded slowly under normal conditions. The combination of the spruce beetle epidemic, the post-war building boom which occurred during the 1950's, development of technology which permitted access to steep lands by harvesting equipment, the development of mill technology to handle the species all combined to bring a quick development of the forests of the high country.

As a crash program whose purpose was primarily the salvage of the tremendous volume of timber, road and harvesting systems developed very rapidly and the effect on the environment was severe. There were few environmental controls at this time except for the basic policies in existence. While the spruce salvage program at first was considered a temporary crash program, it set the basis for a new level of harvest in the Flathead National Forest which has continued to expand since that time. The area that was considered operable has increased and continued to increase until it included virtually all the available forest land in the Flathead National Forest. All species of trees became marketable, the minimum diameter has continued to decrease and so the allowable cuts and the amount harvested has continued to grow. The allowable cut was increased to 64 million in the 50's and during the spruce salvage program was exceeded every year. As it became plain that this level of harvest would continue, the forest was re-analyzed and a proposal for "Full Use and Development of Montana's Timber Resources" was submitted to Congress by Montana Senators and Congressmen in 1959. It explained that Montana timber had gotten into the national market in the 1950's and Montana's national forests had now become important in providing for the national timber supply. It proposed that Montana's primary manufacture of timber could be increased three-fold with an eight-fold increase in secondary manufacture as the basis for a greatly expanded economy. A program was described as one "designed to fully develop Montana's resources for the long time benefit of the nation." It included shifting of additional manufacturing plants to Montana, expansion of transportation needs, including roads and highways, a program of reforestation, greater staffing for timber sales and considerable emphasis on the use of national forest for timber production. It also called for the expansion of recreation development and for water management. "Forest development plans should recognize the needs for assuring timeliness, quantity and quality of waterflow."

Montana was selected as a model for other western states. Although the program mentioned that production in western Montana in 1957 was at 830 million feet on an estimated sustained yield of 780 million feet it explained that by readjustment in species taken, by taking smaller size and lower quality of logs, and the extension of a road system to permit greater salvage, the allowable cut could be increased to 855 million feet in addition to a possible harvest of 1,234 thousand cords of pulp wood. The allowable cut for the Flathead National Forest was increased to 137.5 million board feet annually in 1961. The annual cut figures in Figure 1 (page 52 A) show that this allowable cut was frequently exceeded.

During the 1960's the demand for Flathead timber continued although the price dropped. The appropriations to the Forest Service were tied heavily to timber production. Earlier requests for increased appropriations on the spruce salvage program and during the period of the 1960's following the program for Montana which then became a national program and increased the allocations for the Forest Service showed that the increased allocation to the Forest Service was more than repaid by the income from the timber sold. The pattern was established of tying increases in appropriations to timber production. Timber production became the main activity of the Flathead National Forest and other national forests. There were other forces at work and the requirements for road construction for harvesting and other forest activities were strengthened.

The Multiple Use and Sustained Yield Act was passed in 1960 requiring the consideration of all uses of the national forests. The Wilderness Act was passed in 1964. Wilderness regulations had, of course, been in effect long before this, and the Bob Marshall Wilderness had been established in 1933: one of the first in the United States. The Wild Rivers Act was passed in 1968. Air and water pollution control acts had been passed during the 1960's. Citizen interest in recreation, water, wildlife and aesthetics continued to increase, but the primary interest in timber production was maintained.

The scientific basis for the management of the forests was based largely on the traditional forestry knowledge of timber production. A multiple use plan was developed for the forest and for the districts which were then the working circle within the forest. The multiple use plans and the timber sales contracts included provisions for concerns over runoff, erosion, stream sedimentation, and other environmental facts. The specific provisions in the timber contracts in the 1960's are not very much different from those in the present (post-1971) contracts.

Enforcement tended to be lax. While cases of erosion, particularly on roads, were observed they were accepted as part of the operation. If roads were built too close to streams or if harvesting had to be carried on across streams, they were done whether it was necessity or convenience. It didn't make too much difference. Although the regulations became stricter during the 1960's than they had been in the 1950's, where only minimal restrictions existed, the pattern of lax enforcement had developed. In the 1960's the price of timber was lower and there was a tendency to disregard restrictions which might cause an economic pinch on the operator.

Getting timber from the Flathead National Forest and other National Forests in the Rocky Mountain region onto the national market was considered a major accomplishment of the 1950's. This was touch and go economically and any restrictions which reduced timber availability or raised operating costs were regarded as a threat. The accepted goal of forest management was to replace the old residual timber with young, fast growing, healthy stands would look like an "orchard." Removing the residual forest, therefore, had a deeper and more important purpose than the production of timber alone and depended on the continuing availability of an expanding market. Economic return to the government, or stipulations for environmental considerations in road construction, timber harvest and so on could not be allowed to seriously interfere with the primary goal. While stricter controls were written into multiple use plans and contracts, they were only minimally observed and not at all if they appeared to offer any hardship to the operator.

During the 1960's, when the demand for timber was down, it appeared critical to continue to relax controls in order to avoid a collapse of the market for Rocky Mountain timber. In a way this was a public subsidy to maintain the timber industry. Mills had been attracted into the area and mills already there had been encouraged to expand on the basis of a continuing and increasing volume of cheap public timber. Cheap, partly by laxness in supervision and enforcement and partly by the consequent accumulation of social costs in environmental degradation.

With the overwhelming emphasis on timber, the timber management division from the regional office and the supervisor's office tended to have a great deal of influence on the decision process. The field staff were largely carrying out orders from higher ups. There was a general acceptance that strict enforcement was not necessary. The forest received instructions in terms of blanket recommendations. Clearcutting became the general recommendation for the harvest of virtually all species. Harvesting equipment was designed and accommodated best to clearcutting. It was the easiest and least expensive to lay out and to supervise.

Road construction became a primary activity of the national forests and a considerable increase in engineering staff occurred and, looking back, many of the roads are considered to be over-engineered, designed mainly to accommodate equipment at higher speeds and greater efficiency, and so the design of both the harvest systems and of the roads tended to clash more and more with the natural environment. Decision-making became broad and general rather than specific to the site or situation. The natural features of limitations tended to be ignored. The system was thrust on the land rather than being fitted to it, but it was efficient in terms of manpower, in terms of machinery and in terms of maximum short term production and profit. The Forest Service as well as the industry and the community adjusted to it and became linked with it. The pressure for increasing the cut continued and in 1969 a new management plan was developed establishing the allowable cut at 194 million feet. A good share of the increase was based on the expansion of commercial thinnings into second growth stands. The change also represented a shift in the period of liquidation of old growth timber to 32 years.

The Flathead Forest like most other forests in Region 1 has a high percentage (43 percent) of its forested area in mature, high risk saw timber stands. The mortality is high in such stands, the loss is estimated at about 18 million board feet a year. A main goal of management is to harvest these old stands and regenerate them with vigorous, fast growing, new stands. As far as production of timber from the forest was concerned, the objective was to maintain an even flow of volume in converting from the old stands to the younger stands. The purpose in expanding the commercial thinning of these young stands is to increase their rate of growth and shorten the conversion period for the old growth timber. Of course, the problem is that this will greatly expand the area of timber harvested each year and also extend the road program.

Provision was made that if the proposed commercial thinning program of 2,000 acres annually didn't materialize within four years the conversion period would be lengthened to thirty-four years and the allowable cut reduced. The plan estimated that 3,270 additional miles of access roads would be needed for effective management of the Flathead National Forest. As of 1967 there were about 1900 miles of road completed. The total acreage of forest harvested and exposed to the elements is not known, but it has been in excess of 2,000 acres per year for the last 20 years. Not all of the harvesting has been clearcutting. Some of it has been in various stages of intermediate cut and a reasonable amount of it has been overstory removal.

The accepted method generally was to clearcut the old growth timber; to burn the slash, either broadcast or in piles; and to expose the mineral soil in order to provide the best seed bed recommended by silvicultural research. Disturbance of the soil is necessary in order to remove the competition of grass, and underbrush and to reduce the depth of duff so that seedlings can survive during periods of scarce moisture. This conformed with the general idea of removing the old natural forest and replacing it with a more desirable "managed" forest. To quote from the 1969 Timber Management Plan, "Current Flathead management is directed toward regenerating desirable species naturally. A stand of mixed species adapted to the site is the objective. This is mainly accomplished by cutting practices which create conditons that are desirable for naturally regenerating the species. Occasionally certain areas need to be planted or aerial seeded to get the desired results. This is still far from optimum management, but combined with precommercial and commercial thinning, tree growth and species composition should improve which should in turn produce a more desirable forest. Some genetic improvement, fertilization, and irrigation may also become part of intensive management." And then again, "Visually the desired forest would approach the appearance of a well managed orchard."

In general it was believed that the soils on the Flathead Forest were relatively stable, that roads if properly laid out and taken care of would not cause too much damage. Some of them had indeed washed out, but they had been replaced. The runoff and siltation from cutover lands and particularly those that had been heavily scarified were recognized but not considered serious. Since there were no standards established for control of sedimentation, runoff, etc., general guidelines seemed to be sufficient. While effects were recognized, it was considered that they were not highly important, that they tended to heal over after a time, that the effects were temporary and could be tolerated as a necessary concommitant of timber harvest. At that time, at least, they were not considered to be illegal. The protest from the public was largely over visual impacts on the environment, especially clearcutting, and extension of roads and timber harvest into previously unroaded areas such as Bunker Creek. There was also some complaint from fisheries biologists and fishermen regarding the streams where road construction had interrupted the run of the native Cutthroat and Dolly Varden trout and also that siltation in some cases was reducing the spawning gravel beds. There was also complaint over projections for extending roads into undeveloped areas, particularly such areas as the Middle Fork of the Flathead River and some of the high country areas like Jewel Basin.

A Case Study - North Fork of the Flathead River

The Forest Service had been estimating the timber volumes and allowable cut in the North Fork drainage since the establishment of the national forest. In 1916 the annual allowable cut for the drainage was estimated at 25 million board feet. No timber was harvested because it was inaccessible physically and could not have been brought to the market at a profit. Periodic forest fires through the area reduced the estimated annual allowable cut to 16.7 million in 1926. Still no timber was harvested. In 1946 the annual allowable cut was reduced further to 14 million board feet, because of continued loss by fires especially in the low country. The spruce salvage program started in 1953 and the annual cut jumped from about zero to almost 50 million board feet in 1955 and started to taper off after that. The allowable cut was increased to about 28 million feet in 1959.

It was during the spruce harvest program that the roads were constructed into the valley seeking the easiest and cheapest route. The access road was extended up the main valley and roads were pushed into the tributary valleys. They were poorly laid out and minimally constructed, but they established the pattern for harvest of the area. The dead and infected spruce was clearcut, largely conforming to the pattern of infection. Succeeding harvest followed the original pattern and a number of valleys were very heavily cut: Coal Creek, Hay Creek and others.

Concern developed because siltation and bank erosion were occurring in a number of the streams and inspections pointed out that these side drainages were approaching the point of hydrologic imbalance. The problem could not be settled by foresters, hydrologists, soils scientists and others, because there was no basis, no hydrologic data, no quantitative data on siltation or nutrient loss or any other of basic biological and physical knowledge that needed to be obtained. The exact condition is not determinable.

The North Fork drainages were the center of the spruce beetle infection and were heavily cut in the spruce salvage program. Harvest was shifted to other areas during the early 1960's to permit the North Fork drainages time to recover. In 1968 to 1970 heavy cutting was again carried out in many of the tributary valleys of the North Fork. This cutting was near or contiguous to earlier clearcuts. The 1969 Timber Management plan called for a rate of harvesting the old growth timber which would remove all of it within 32 years. The conversion period was based on the estimated period required for the younger forests to reach harvestable age.

The conversion rate was, it needs to be emphasized, based primarily on the considerations for maintaining the output of timber. It was not based on considerations for the environment. Only recently have such concerns been expressed. In the next portion, we will review the inspections and comments of the Forest Service personnel after 1971 when they reviewed the North Fork in the post-NEPA period. In the 1969 plan, however, it was assumed that the heavy clearcutting in the North Fork was not causing undue sedimentation, erosion and hyrologic effects; or that the amount caused was, somehow, acceptable. While some effects were noticed, they were considered transitory and would soon heal. The argument for the rate of timber harvest was based on ample data on volumes and growth rates while the considerations for erosion, sedimentation, stream channel effects and so on were based on observation, not quantified data.

The level of harvest now hinges on the 32 year conversion period for old growth timber proposed in the 1969 Timber Management Plan, There is pressure particularly on the part of industry to hold to that conversion period or in fact perhaps even reduce it in light of the recent report of the Presidents' Panel on Timber and the Environment (PAPTE). The argument advanced is that since available knowledge does not prove that harm would be done by an accelerated rate of cut, that cutting should proceed on the shorter conversion period. Inspection reports by hydrologists and others express considerable concern over the condition of a number of the side drainages on the North Fork. A forest hydrologist believes that 32 years is far too short and conservatively estimates a far longer conversion period from the standpoint of the protection of the watershed, but again he admits that he does not have data to prove this. The Forest in its proposed 1973 timber management revision proposes a fifty year conversion period as a reasonable compromise, but again the data are not there to prove or disprove this position. The reasonable approach where danger is forseen, is that a cautious approach be taken in the light of lack of knowledge and that every effort be made to seek this knowledge as soon as possible.

The lessons to be drawn from the North Fork are really not available because of lack of quantified data, and whether or not it conforms to the requirements of the 1972 amendments to the Water Pollution Control Act is not known. The provision that past damage should be repaired applies here and until effects are quantified the extent of repair will not be realized. The North Fork is a lesson but one that cannot now be fully identified and the practices that have been instituted as a result of the lesson which appears to have been learned can also not be evaluated at this time. And because it cannot be evaluated it may not be defensible from any standpoint.

B. Changes Since 1971

In June 1971, a new Supervisor was appointed to the Flathead National Forest. In the two and one-half years since then a new organization and program were established. There has developed a sense of responsibility and accountability in the staff, brought together into a hard working team. They have gone a long way toward instituting a program for "the protection and enhancement of the environment".

The staff was asked to delineate what it considered its major accomplishments. They are listed briefly here and will be discussed in greater detail later after a look at recent inspection reports of past forest activities.

1. Development of the Coordinating Requirements for the Flathead National Forest and a decision that no timber would be sold

without land use plans.

2. Reorganization of the staff to a program basis, as opposed to a functional basis, and identifying responsibility and accountability.
3. Expansion of resource specialists to include staff in soils, hydrology, fisheries, wildlife, geology and more silviculturists.
4. Revision of the timber management plan and a reduction of the annual allowable cut in 1972.
5. Cracking down on enforcement of contact provisions and establishing authority to do so.

Inspection and Review of Previous Activities

Starting in 1971 and continuing to the present time the Forest Service has sent inspection teams from the Regional Office and the Forest into the field to review previous activities in order to provide an understanding of what had occurred and to recommend changes in operations to meet the requirements for "environmental protection and enhancement".

These documents constitute the evidence that the Forest Service itself recognized environmental degradation from past practices and the need for change in its operations.

In all cases the judgments are made on the basis of observation by people with training and experience in substantive areas: They are not based on quantitative data derived from measurements. The conditions can be pinpointed but they cannot be evaluated in quantitative terms.

1. The North Fork of the Flathead River. An inspection team from the regional office which reviewed the Flathead National Forest August 6-10, 1972, reported the following: (emphasis added)

The National Forest lands in the North Fork of the Flathead River Basin were heavily cut during the spruce bettle infestation beginning in the early 1950's and also during recent years. During 1968-70, extensive cutting occurred on many tributaries of the North Fork. Recent cutting has been near or contiguous to former sales.

Aerial view of the North Fork drainages leaves the impression that developed drainages have been overcut and "hurt". Concern has been candidly expressed outside the Service as well as within the Service as to how sales can be repeated so frequently in the same drainage without causing soil damage and irreparable damage to stream channels, water quality, water yield, and stream habitat. The question of excessive siltation, scoured streambeds, timber removal on creek banks, skidding along and across streams, the miles of clearcuts along drainage courses, removal of 65 percent of the total volume on 15 percent of the acreage are all quality management considerations affecting soil and water.

The increased rate of waterflow and extended duration of peak volumes for each stream are discussion subject materials within the Service as well as outside the Service.

The Forest has inventory information that timber stocking on most of the clearcut areas is sufficient. There are some areas in which the stocking is not sufficient. Cutting areas in the North Fork generally have a dense brush cover. The Forest is attempting to get accelerated reproduction in some of those areas where stocking is not sufficient by vertical dozer scarification. The Forest hydrologist indicated there were some calculated risks involved. With average weather conditions and proper execution of predetermined specifications, it was believed the operation could assist in getting reproduction without accelerated soil erosion.

There is a concern that in the properly stocked clearcut areas, the reproduction has been slow in coming and growth has not been sufficient for the length of time involved. This is an important factor since hydrologically this influence in relation to tree height, snowmelt, infiltration rates, water yield, water quality, and a good mix of resource management is of prime importance in the management of watersheds in the North Fork.

The North Fork drainages which have been developed in the past show a preponderance of evidence of the violations of the former Regional Multiple Use Guides and Ranger District Multiple Use Plan decisions. High area, stream influence, and travel influence zone definitions and coordinating requirements and basic decisions have in the past been violated.

> The Forest is developing a sensitive awareness of this and has taken positive steps to assure soil and water protection by the establishment of marginal areas. This is a hold action until such time that skidding systems or other systems of logging can be developed which will assure reasonable protection of the land and its water.
>
> The shifting of allowable programmed timber harvesting is also being accomplished.

A number of reports by various specialists in the Supervisor's office refer to the North Fork. A report made on July 26, 1973, mentioned that there was

> "serious soil erosion and stream siltation on Whale Creek near the confluence of Inuya Creek that starts in a high burn in a basin at the head of the Inuya Creek. Large charges of water surged down carrying rubble into the culvert at the Whale Creek road. The culvert is plugged, water washes silt into Whale Creek."

The recommendation was to remove the culvert and establish a new one.

Another report on August 3, 1972, says that erosion and siltation is mostly from roads: washouts, bank cuttings, slides, etc, etc.; resulting mostly from poor location and lack of drainage maintenance. It is recommended that new culverts, additional culverts, relocations and maintenance be institued. Improper road drainage is noted as the main cause. Revegetation of cuts, fills and fertilization are prescribed in order to get the vegetation started. Inadequate erosion measures and control of temporary roads and skid trails were noted.

In a report of November, 1972, on the Coal Creek Timber Sale the new silvicultural objective was given as "the improvement of aesthetics by the removal of overmature and decadent trees using small clear cuttings". Erosion control was rated at "3 in a classification of 1 to 5". No erosion was anticipated if proper control measures were used. "Non-specific" skid trails and other roads should be obliterated or cross ditched and grass seeded. The sale called for removal of all materials to a 3 inch top. The environmental statement discusses stream-side protection. It mentions that "there will be minimal soil erosion from ground disturbance and that this is unavoidable and inevitable". (The new provisions are expected to greatly reduce erosion over previous practices, but, it appears, that it cannot be eliminated.)

A report of July, 1972, mentions that the Fall Creek drainage in the North Fork "is drastically overcut and should be deleted from any future logging plans for at least 10 years".

A report in July, 1972, remarks that on Whale Creek in the North Fork, "there is continual deterioration of the channel and it is best to discontinue timber harvest in this watershed for 25 to 50 years".

On May 19, 1972, in a review of Packer's[1] Bulletin, "Terrain and Cover Effects on Snow Melts in a Western White Pine Forest," it is recommended by a Flathead hydrologist that "A working knowledge of snow pack reaction to management is an essential tool on the Flathead".

He explains that:

> Snow melt is primarily dependent upon direct radiation to the snow pack and by heating from convection and conduction resulting in snow mass warming. Delayed melt usually results in an increased melt rate. An increase in melt rates results in sharper peak flows and subsequent channel damage. This is especially critical in poor channel condition areas such as the North Fork. By clear cutting low energy and horizontal slopes at intermediate and high elevations snow melt has been delayed and rates have been increased. As a result channel damage from increased peaks has occurred. Conversely clearcuts on high energy slopes result in earlier melt and some degree of desynchronization with peak flows from low energy slopes. As Packer points out, snow melt rates are lowest where canopy densities range from 25 to 45 percent at intermediate to high elevations.

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[1] Paul Packer of the Forest Service Intermountain Forest and Range Experiment Station

In the tributaries of the North Fork it would seem that there is sufficient evidence to suggest that future timber harvest should be directed to this end. This is old hat, but I will repeat it again. Partial cutting in the low energy slopes and small clearcuts on high energy slopes. The situation is probably beyond the point where this type of management will have significant affect, but it may help in stabilizing the situation.

The Regional office inspection team mentioned other drainages in the Flathead Forest:

2. Lost Johnny Creek. This creek drains directly into the Hungry Horse Reservoir. Timber cutting operations have progressed up the drainage and currently are located in the upper Johnny Creek.

The active timber sale in this area is being modified to assure quality management and protection of the soil and water resources that are located in the high area zone. Roads are being closed to protect the basic resources. However, there is evidence of irreversible soil and water impacts in the Lost Johnny Creek drainage. Soil has been forced into stream channels, roads have been washed out, and coordinating requirements of the former Regional Multiple Use Guides violated.

The District Ranger and his assistant do exhibit an awareness of the soil and water problems involved.

3. Spotted Bear River. The lower Spotted Bear River drainage is being developed. The initial thrust of road building and timber harvest operations have started and progressed to the Beaver Creek Campground; 7.1 miles of additional road are being constructed and completed into the Spotted Bear drainage proper and the lower portion of Whitcomb Creek drainage (commonly called the Dean Ridge Road).

The developed portaion of the lower Spotted Bear River drainage has in the past been a topic of discussion for the public as well as for the previous Regional Forester and staff. Violation of the Region's initial Regional Multiple Use Guides and Ranger District multiple use plan decisions have left some irretrievable impacts. Some difficulty is being experienced at the present time in connection with recent road construction operations in this drainage. The soil and water impacts because of road width and road location problems where the road divides near the mouth of Whitcomb Creek, the large slump because of "cutting the toe of the slope" on the initial Whitcomb Creek section, and the existing and potential problems generated in a small slump after crossing Whitcomb Creek are items which demand a Forest look at what land ethic and quality management really is in the eyes and mind of an engineer, soil scientists, hydrologist, forester, and District Ranger.

4. Bunker Creek. Bunker Creek is being developed. This drainage also has a long history of public concern and controversy. Development in the drainage has also caused some diverse thinking and opinions within the Service over the past 15 years. A timber sale of 31 million board feet was sold with some 15 cutting units involved - basically to clearcut. In 1970, the new District Ranger became concerned as to the impact of the timber harvesting systems, particularly clearcutting, removing 31 million board feet of timber in this sensitive and high water-producing basin.

Through established administrative procedures of District Ranger, Forest Supervisor, Regional Forester, and Comptroller General of the United States, the Bunker Creek timber sale contract has been modified as to total volume, harvesting systems, and area to be cut over. One of the prime purposes of the modification has been to protect soil, water, and wildlife from unnecessary impacts of logging and road construction.

In traveling to and within the Bunker Creek sale, it was observed that the roads appeared to be, in some instances, wider than necessary. Excessive road clearing was causing additional debris to enter creek channels. We observed current road locations which had been made and partial construction completed in the creek bottom. Corrections had been made as soon as detected; however, degradation of the soil and water resources had already occurred. Soil was being forced into Bunker Creek.

Cat skidding in one of the lower units had been completed. This was one of the best cat skidding jobs ever observed in this Region in relation to the minor impacts to existing soil and water conditions.

There inherently exists a general and intensified road drainage and general soil and water problem in the Bunker Creek operation which is characteristic of this and other high water-producing basins. Irretrievable project impacts on soil and water can easily be made. Early spring season road construction had caused some water and soil problems. Good road location, construction, and proper drainage are of prime importance in preventing irretrievable impacts.

The Flathead has taken positive action in road closure accomplishment in Bunker Creek. The information we received as to future Forest plans and objectives of the road closure program appeared to be logical. This action is long overdue. The reduction in loss of soil, better drainage continuity, and improvement in water quality are products of this endeavor. Protection of the grizzly bear in the Bunker Creek drainage could be another. General wildlife protection, when needed, could be enhanced.

5. Puzzle Creek. The Flathead Forest has begun construction of a road from U. S. Highway No. 2, up Skyland Creek through Skyland-Dodge Creek saddle, past the old Challenge Guard Station to the

headwaters of Morrison Creek, lower Puzzle Creek and upper Twenty-Fiver Mile Creek areas. The original plan was to continue construction of this road down Morrison Creek to the mouth of Morrison Creek, to the old Shaefer Ranger Station and onward to the Spotted Bear River via Dean Ridge. Public sentiment has caused a reappraisal of this proposal.

Several timber sales have been made in the process of constructing this road system to its present termini in the Morrison Creek area. Some of these sales are also located in the high water-producing basins where soils are sensitive. Portions of the area are extremely moist and boggy. Ranger District personnel became concerned about the damage being done to soil and water in logging and road building operations in the Puzzle Creek sale. The result has been a modification of timber sale contracts with the objective of completing current and agreed upon commitments and at this point, curtailing further operations until such time that logging systems can be developed which will not leave irrectievable damage to soil and water as well as other resources.

There could be a question as to the extent of damaging impacts on the areas logged and roaded in Skyland, Dodge, Puzzle, and Morrison Creek. This area also appears to have been "hurt". Soil is moving into the creeks and the quality of water has been affected. Roads appeared to be of greater width than needed or desired, and road drainage is a problem. One road was constructed through two snow avalanche paths.

Stream influence zone and travel influence zone coordinating requirements of the past Regional Multiple Use Guides have been flagrantly violated.

Dozer piling on a small burned area and on a clearcut area appeared to be greatly excessive. The areas, in fact, looked like plowed fields. The depth of the disturbance appeared to be such that the future capability of the soil for regeneration of any kind is seriously questioned. This needs to be considered in field quality management training sessions.

Some further effects are discussed by staff specialists.

On July 7, 1972, the Gregg Creek Timber Sales, a report by the fisheries biologist, Soil Scientist and hydrologist:

> "We looked at the effects of clear cutting in the Gregg Creek watershed Talley Lake Ranger District. There was ample evidence of overland flow in the clearcut areas. Generally overland flow does not occur in undisturbed forested areas. Gully and sheet erosion were a result of water flowing over scarified soil. Much of the silt from the eroded area was found in Gregg Creek. Water which had flowed through debris piles exhibited a turbid appearance. Several shallow ponds which had formed below debris piles contained a

> considerable amount of green filamentous algae. The algae is a fresh water algae commonly found in the warmer water where there is sufficient nitrogen and phosphorus. Water samples were taken below the debris pile and at a point in the mainstream approximately one-quarter mile downstream. The downstream sample showed more dissolved oxygen and a slightly cooler temperature. Ranger Kline called our attention to this area and suggested there has been watershed damage due to logging. Onsite damage is obvious, but downstream effect is probably negligible. The area might serve, however, as an in service educational area to show possible physical and chemical changes in the water source."

This information is based on the observation of specialists with some sampling, but no monitoring has been developed. The interesting thing is that this is a documentation of onsite damage and an implication that harvesting will always have some effect.

Major Accomplishments Since 1971

In listing what he considered his major accomplishments, the Forest Supervisor discussed each point as follows:

1. During the development of the Coordinating Requirements for the Flathead National Forest the decision was made that no timber would be sold without land use plans. The spirit and intent of the Coordinating Requirements became the most significant policy for the Flathead National Forest. The CR's were approved by the Regional Office in November, 1971. The Land Use Plan became the basis for timber harvest.

2. Reorganization of Flathead Forest was authorized by the Chief of the Forest Service. Two forests in each region were permitted to experiment with reorganization. There is now greater accountability. Rangers have more responsibility for the decisions on their own districts

and are held accountable for their decisions. Ranger staffs have been strengthened by transfers from the supervisor and regional offices. The reorganization had the potential to weaken construction supervision so this activity was held in the Supervisor's office. However, Construction Supervision personnel report to the district ranger when working on a district.

3. The timber management plan was revised in 1972 and the annual allowable cut was reduced from 186 to 156 million board feet. The environmental impact statement on the revised plan is under review. The programmed sell depends on manpower available and was set at 107 million board feet for FY 1974. The revised plan has been challenged by industry and was the basis for the Dils[1] report in 1972. Timber Management Planning and Land Use Planning are complementary and the new Timber Management Plan will be used to advance the Land Use Planning activities. The figure resulting will become the basis for the annual allowable cut. The allowable cut will be discussed in detail later.

4. Enforcement of contract provisions has been intensified. A key problem has been overloaded log trucks which cause damage to bridges, road surfaces, structures and culverts. This has been a persistent and pernicious problem. Enforcement in the past penalized only the truck driver. Flathead Forest officials are now taking enforcement action against the timber sale contractor. Timber sales have been closed

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[1] A Study of Forest Management Practices on the Flathead National Forest, Montana. R. E. Dils et al. for the Kalispell Chamber of Commerce (Mimeo) October 1972.

down for the first time and the regional office supported the action.

Now that the right to cancel sales for overloads has been established, Flathead forest officials feel that they have the authority to close down sales for violation of environmental stipulations. The contract can now be used to enforce compliance. There has been strong reaction to such enforcement procedures by industry. Announcement of new USDA regulations on Cancellation of Contracts was published in the Federal Register on April 23, 1973. With this new regulation Flathead forestry officials feel that enforcement can become even more effective.

5. The specialists were added during the reorganization. The staff of the Flathead find that the hydrologist, soils scientists, geologist and silviculturists have been a great help and it is recognized that more help is needed. The half-time services of a fisheries and a big game biologist are also available. Individual districts are approaching the time when they will need a silviculturist and an engineer and possibly other specialists on a full time basis. It is not the job of the specialists to determine specific action but to analyze and point out consequences and alternatives. The ranger (with the advice of specialists) makes the decision and is accountable for the decision. If the ranger ignores the advice of the specialists, the Supervisor's Office acts as mediator.

Accomplishments of the Flathead National Forest staff are recognized in the Regional Office inspection report of August, 1972:

> Its People
>
> The Flathead Forest received a new supervisor in June 1971. The Flathead people we traveled with during this inspection left us with the impression that they are a dedicated, forthright group with a

new look and perception being developed as to balanced water and soil management. The turnaround which has occurred on the Flathead in connection with soil and water management and other resource management problems is one, which when compared to that found on the Forest 5 years ago, is an indication of positive progress. The recognition of past damage to soil and water through past poor management practices appears to be an accepted fact with a considerable number of Flathead people. The sophisticated planning procedures, public involvement, complete change in organization format, approach to Forest problems, modification of timber cutting systems, modification of going timber sales, and establishment of marginal areas for timber harvesting, all attest to the support for some protection of soil and water in the high area basins which the Flathead Forest now finds itself working when constructing roads and harvesting timber crops. These are areas of delicate soil and water complexes with high water-producing capacity.

Its Quality Management

There is accountability for responsibility on the Flathead Forest. The first which has been observed in this Region since 1954. Flathead people appear to be striving for quality results for managing the soil and water resources. There is evidence of a people's trend on the Flathead to move from a sawdust or single-use oriented management to high quality management mix, including a proper mix of soil and water with other resources. The mix of values by priorities appears to be the beginning theme of unit land management. The Flathead desires through its skilled people, its organization, and management to apply the proper mixes of its skills in getting proper soil and water management and overall quality management. Planning how to emphasize soil and water values is in progress. The implementation of these plans in project work to enhance these values needs wholehearted and progressive Forest Supervisor and overall Forest support. The strengthening of people's awareness of solid and water values and the interrelationships with other resource values in exercising control over all project work and especially in road construction and logging operations is beginning to be recognized and in evidence on current operations. Rapid progress is in evidence in some areas and on some projects while on others there is a need to move forward.

The people of the Flathead have the obligation to maintain and sustain a reasonable supply of commercial products from Flathead National Forest acres and at the same time protect the basic soil and water resources in their value relationship to other resources. The continued development of a mutual Forest understanding of quality management and a basic land ethic should assure improvement of water quality and yield and leave the soil in the high water-producing basins where it belongs.

Modification of Existing Timber Sales

In 1971 the Forest Service decided that the environmental restrictions of the National Environmental Policy Act had to be imposed on sales that were already in existence. The first such revision was worked out on the Bunker Creek sale on the South Fork of the Flathead River. This was a test case. The Office of Comptroller of the U.S. Department of Agriculture supported the change and a revision was worked out in a mutually satisfactory way with the timber sale purchaser. On November 16, 1971 the Chief of the Division of Timber Management in the Missoula Regional Office solicited immediate knowledge on other sales which needed modification. Among others the Flathead Forest recommended modification of the Puzzle Creek sale.

There is usually an elapsed time of several years from the time timber layout starts until harvesting is complete. The Puzzle Creek sale was laid out in 1967 to 1969 and the contract let in 1969. Harvest was started, but was still far from complete when the environmental requirements were imposed. In order to show how this was done the Puzzle Creek sale was selected as a case study.

A Case Study - The Puzzle Creek Sale

The sale area and some of the natural hazards are described in the timber sale contract: "The Puzzle Creek Drainage begins on the west side of the mountain chain that forms the Continental Divide and terminates at its confluence with Morrison Creek which flows into the middle fork of the Flathead River. The drainage area covers approximately 2800 acreas.

Elevation ranges from 5600 to almost 8000 feet. Puzzle Creek, which is a third order drainage, is an upper tributary to Morrison Creek which has a total drainage area of approximately 24 square miles.

"Mean annual precipitation in Puzzle Creek ranges from 45 to 65 inches with more than half of the area in the 55 inch zone. Total estimated water falling as precipitation in the drainage is 12,955 acre feet per year. Approximately 55 percent of the mean annual precipitation is available for runoff as either surface or ground water. This means that there are approximately 7,000 acre feet available as runoff.

"The area is generally characterized by numerous first order drainages that are deeply entrenched with 30 to 50 percent side slopes. There is evidence of considerable ground water movement throughout the watershed. Peat bogs can be found on some of the poorly drained areas. Soils in the area consist of a loess cap of about 12 to 18 inches and has higher permeability than does the residual clay soil below it. Consequently, water entering the surface at a rapid rate cannot be absorbed by the clay soils. The result is a free water movement between the loess-clay interface. Disturbance on a hillside such as this usually results in mass failures."

Shortly after the sale started the Forest Service became concerned, halted the sale and initiated an investigation of the area. A review of what happened is discussed in a document entitled, "Cancellation Proposal Puzzle Creek Timber Sale Flathead National Forest."

Following this report from the Flathead National Forest a group of regional specialists visited the site in June 1973 and made an in-depth technical review of the problems.

CANCELLATION PROPOSAL
PUZZLE CREEK TIMBER SALE
FLATHEAD NATIONAL FOREST

Synopsis

The Puzzle Creek Timber sale was contracted by the Flathead Forest to the Stoltze Land and Lumber Company of Kalispell, Montana, in December of 1969. The principal contract items were the sale of 12,410 MBM of sawlogs and construction of 6.15 miles of main road.

Logging and road construction started in August of 1970, and continued sporadically until July of 1971. At that time the District Ranger administering the sale requested that operations be stopped to allow a re-evaluation of adverse environmental impacts which were occurring.

A first evaluation of the area by resource specialists in July of 1971 indicated there were complex soil-water interrelationships in the sale area needing much more consideration than given previously. This initiated sale modification proposals by the Forest Service to the purchaser. All proposals were rejected by the purchaser. During this period intensive resource evaluations were made which indicated the need for review of all of the possible resource impacts of the sale. A team made up of a Soils Scientist, Hydrologist, Geologist, Fisheries Biologist, and a Silviculturist subsequently made the review of July of 1972.

The conclusions drawn from the investigation were that, as originally sold, the sale would cause irreparable damage to soil and water resources. In addition, regeneration of the cut-over areas would not be possible in the time frame required by Forest Service policy. The fisheries resource would be damaged, and accelerated wind-throw of spruce and subalpine fir would be probable in the remaining stands with serious accompanying spruce bark beetle buildup. These risks of substantial wind-throw and a bark beetle epidemic in this area with so many critical resource problems, make any decision to continue the sale, as advertised or modified, subject to a great deal of uncertainty and a high degree of risk. The very wet sites, along with high incidence of past wind-throw evident in the area, are solid indications of wind-throw problems if the stands are opened up.

The District Ranger, based on the conclusions of the specialists and his professional judgment as tempered by service-wide, Regional, and Forest Management Direction, has recommended cancellation of the sale. In his judgment the consequences of continuing of the sale as designed or re-designed are unacceptable, legally (Multiple Use Act), policy-wise (re-generation requirements), and administratively (Management Direction by the Regional Forester and Forest Supervisor).

When confronted with the Ranger's conclusion, the purchaser's authorized representative stated that his Company would sue the Government for damages if a unilateral attempt at cancellation was made.

Background Data

Sale Statistics:

The sale area is 3,200 acres.
Total proposed cutting area is 835 acres.
(All clearcutting)
Total Volume sold 12.4 MMBM
Road Construction 6.15 miles of specified roads with a total cost allowance of $68,315.

Contract Items Completed:

One cutting unit has been completed and another is substantially completed.
Total volume removed from the cutting units and road clearing is 2,655.28 MBM.
Road construction consists of approximately 5.7 miles complete or substantially complete. Other specified roads have been pioneered and spur roads have been constructed.

Volume Available to the Purchaser:

Unit 2 containing 880 M is roaded and available to be logged. In our opinion it is environmentally sound to do so.

Modification Proposals to Purchaser:

1. September 23, 1971. The purchaser was approached with the following proposal:
    - Reduce contract timber volume from 12.4 MM to 7.3 MM.
    - Reduce total acreage cutover from 835 to 593 acres.
    - Reduce clearcut acres from 835 to 295.
    - Reduce road mileage 0.3 miles and reduce standard for for 0.25 mi. of road to spur standard.
    - Adjust stumpage rates accordingly.

   The purchaser rejected the proposal stating that the original contract volume must be met as a prerequisite to bilateral modification.

2. June 5, 1972. (After intensive resource investigations) The District Ranger proposed a revised volume to be removed by conventional method (tractor and jammer) of 6,380 MM. An additional 880 MBM could be removed by cable yarder with a 1,000 ft. skid capability.

   The purchaser rejected the proposal for the same reason as he rejected Proposal #1.

3. Additional attempts to reach agreement on bilateral modification were made in meetings with the company on November 7 & 17, 1972. At these meetings the purchaser agreed to accept (in principle) a modification proposal providing agreement could be reached concerning volume, logging costs and the actual unit boundaries marked on the ground.

   In addition, the purchaser explored the feasibility of helicopter logging. He felt that if stumpage prices were reduced to minimum and the sale was logged as originally sold, it would be feasible to remove about half the remaining volume by helicopter.

4. Subsequent re-evaluation of the specialists report, F.S. policies, and the preparation of a draft Environmental Analysis Report resulted in the Ranger recommending unilateral cancellation.

5. On March 27, 1973, the purchaser was advised that on the basis of the Environmental Analysis Report completed in January 1973, the District Ranger would recommend unilateral cancellation.

6. On May 18, 1973, a meeting was held with the purchaser to explore the possibility of logging areas under the present contract, that could be logged without undue environmental impact. This would include Unit #2 and some risk material along the main road. Approximately 1 to 1.5 MMBM could be removed in this manner. The purchaser was reluctant to make a commitment until after checking with his legal representatives in case this would jeopardize future court action. He stated he would have a position in about two weeks and would advise us.

   He also indicated that the company was committed to other logging operations this season. As a result, it would be questionable whether they would have a logger free to work on the Puzzle Creek Sale.

Summary

The intensive resource evaluations conducted by a multidiscipline team examined the environmental consequences of fulfillment of the contract.

The Ranger, using the specialist information, evaluated alternatives for completing the contract. This included logging as originally contracted... a partial cut throughout the sale area, a long-term sale cutting only high risk trees, and modifying logging systems to mitigate the newly recognized environmental impacts both with and without the use of helicopters. He also examined the alternative of unilaterally cancelling the contract.

Analysis to date reduces the acceptable alternatives to one:

1. Unilaterally cancel the contract. The basis would be the service-wide policy on timber sales adopted as outlined in "National Forests in a Quality Environment Action Plan". Problem #4, page 11 of this publication states; "To recognize those areas where the final harvest cut must be discontinued or deferred because there is not assurance that the area can be suitably restocked within five years after logging". Any partial cutting on the wet spruce sites involve unacceptable risks of heavy wind-throw and associated insect problems.

This policy also includes direction to Forest Supervisors to identify problem areas on the ground and incorporate in timber management and multiple-use plans. It also gives direction to modify, where appropriate existing timber sales contracts containing such areas to prevent harvest cuts in those stands where satisfactory regeneration cannot be expected within five years.

In viewing this direction and the other Puzzle Creek Sale resource protection problems, the only other course of action is "timber mining". This would enable us to fulfill the contract and protect most values.

Unilateral cancellation would adversely affect the profit the purchaser has expected from the contract. The apparent possible profit loss is about $202,800. This figure was obtained by calculating the profit that could be expected by harvesting and processing the remainder of the original contract timber volume. The actual loss to the purchaser, if any, is not known. Royce Satterlee, purchaser's representative, stated that losses to the company would be in excess of $300,000.00.

SPECIALIST REVIEW
PUZZLE CREEK TIMBER SALE

Introduction

In late June 1973, E. M. Richlen, H. J. McKirdy, F. W. Pond, and J. E. Eggleston were requested to review the "Environmental Analysis Report, A Proposal - Cancel Puzzle Creek Timber Sale Contract" and to discuss this proposal with Timber Management. The memorandum concerning this meeting is under file designation "1930 - Environmental Analysis" dated July 2, 1973.

On August 3, 1973, Richlen, McKirdy, and Eggleston were requested to review the Puzzle Creek Sale Area on August 6-7 to examine the situation on the ground, and to evaluate another modification of cutting units and road locations as proposed by Radtke. We briefly discussed our findings with Dave Minister in his office on August 7. This report is the result of the August 6-7 field trip. Forest personnel involved with this review were Delk, Martinson, Casey, Ostheller, and Hook.

Discussion

During the review of the Puzzle Creek Timber Sale Area, we looked at severa "different areas" of land. These areas are discussed, more or less, individually.

The spur road from Road 2848 into cutting unit No. 2 exhibits many characteristics common to Land Unit A. Slumps have occurred along the banks of Puzzle Creek under natural conditions, as well as along the road. Any removal of vegetation from or above this land unit will adversely affect an already precarious situation. The soils of this unit are almost completely saturated during the entire snow-free period and are supersaturated during the snowmelt period. Any vegetation removal will increase the amount of water by an estimated 15-20 unit area inches. This increase will aggravate both the slumps on the road and on the creek bank. This effect will take place just by removal of vegetation through timber harvesting - by any means - and is independent of those effects that would be caused by road construction.

We also walked over the upper spur road in timber sale Unit 2 and portions of the two lower spur roads. We were under the impression that only one spur road was to be built in timber sale Unit 2 when in actuality four spur roads were built (the uppermost was a very short abandoned spur road). The two lower spur roads were less than 150 yards apart and portions were in very clayey soils. Runoff from these soils will contribute high amounts of clays which will greatly increase turbidity in adjacent stream. Logging equipment, depending on soil moisture, will either compact the soil or create a muddy quagmire. In either case a lowering of productivity can be expected along with high stream turbidity. The bulldozer operator constructing the roads was somewhat embarrassed by closeness of the lower two roads and said he just built roads where they were flagged. The logging team working on the upper spur road indicated the area between the two major snowslides (total clear-cut area) was to be tractor logged. We were also under the impression (environmental statement) that this logging unit was to be cable skidded.

The review team walked the proposed new road location through cutting Unit 7 and to the termination of the road in Unit 8. In Unit 7 the road crossed several high mass failure areas and a logging landing appeared to be located on a high mass failure area. Briefly discussed was the possibility of making a log road (corduroying) across unstable soil areas. This type of road construction can cause serious compaction in the underlying soil materials (see discussion on slope hydrology.)

A good stream crossing had been located on Puzzle Creek between Timber Sale Units 7 and 8. The road location beyond the stream crossing to Unit 8 contained both stable and highly unstable soils (high mass failure areas). The proposed road in Unit 8 was located in dominantly unstable soils (very high mass failure). Besides having a very high mass failure potential, the proposed road will have a very adverse effect on the slope hydrology.

"SLOPE HYDROLOGY" is not too well understood, often misinterpreted, or overlooked, and it is difficult to discuss the hazards and impacts in a few brief remarks. Some of the more dominant factors involved in slope hydrology evaluations are climatic conditons, land surface configuration, hydrologic events and the controlling soil characteristics. Depending on the specific situation, any of the above dependents can be a dominant factor. For example, soil infiltration, percolation, and transmission rates, among other soil characteristics, affect subsurface moisture movements. Although a number and variety of management impacts can be developed, the following discussion will be confined to those involving roads. The effects of slope hydrology can briefly be described in several ways. One of the effects occurs when the road is constructed through the land surface as is the present road (2848). The road cut will intercept a portion of the subsurface flow, forcing it to the surface where it must be transported in ditches or culverts. This will accelerate the flows from the area and will increase the volume of water during the peak flow period. This surface water also carries increased suspended sediments to the streams. Part of the increased sediment will come from the tributary stream channel presently in equilibrium but due to increased water directly related to the road, start to degrade as a result of the increased water. Besides producing higher peak flows, lower dry season flows will occur.

Another similar slope hydrology effect results from turnpike road construction wherein the compaction and weight of the road materials compacts the underlying soil. This restricts subsurface flows, causing hydrostatic pressure to build, producing "blowouts", "slumps", or soft spots (boils) in the road. Water problems are similar to those described in previous paragraphs.

Still another slope hydrology effect of more subtle consequences relates to the vegetation - its productivity and habitat type. In areas where the slope hydrology is adversely affected, the soils above the road will increase in wetness (supersaturation) and drier areas below the road due to the sharp decrease in subsurface moisture movement. The long-term effect would be a potential change in habitat types above the road and below the road.

The effects of slope hydrology is best exemplified in main road 2848 through Land Unit A. The soils in Land Unit A are dominantly clay loams which compact easily under optimum soil/moisture conditions. This compaction can also cause the subsurface water to surface due to the reduction in permeability and transmissibility. This situation was exemplified by one culvert in road 2848 where nearly twice as much water was coming out of and around the lower end of the culvert than is flowing into the culvert from the ditch (upper end of culvert).

The addition of water resulting from road interception and transported through culverts and stream channels or vegetative manipulation resulting in higher peak flow volumes (example - spur road to Unit 2 and vegetative removal above the spur road) will accelerate the aggravation of the streams of Puzzle Creek.

The results of roads built higher up the slopes in Land Unit D (cutting Units 5,6,or 7), would be similar to those mentioned, except that the hydrostatic pressures would be greater on the steeper slopes, and the resistance to blowouts would be less.

A water yield increase from cutting Unit 8 would cause very undesirable results in two different locations. Tree removal here will also increase the available water by 15-20 inches as noted earlier. A portion of Unit 8 (that portion where the proposed road was located) lies on slopes of about 40-50 percent. At the base of these steep slopes, where they meet the Puzzle Creek terrace, are located many bogs, seeps, peat deposits, and springs. Any increased yield on the slopes above these wet areas will increase the hydrostatic pressure on them, and make them more susceptible to "blowouts" or slumping. If slumps do occur, they would be right on the banks of Puzzle Creek. A significant increase in the amount of sediment introduced into Puzzle Creek would occur immediately, and would continue to occur for a long period of time.

Some of the water from this proposed cutting unit will follow the dip slope of the underlying limestone beds and emerge in the vicinity of the large slump located below the lower end of the Morrison Creek Road. This slump does show some evidence of movement by water from within the slump itself, as well as continual sloughing from undercutting by Morrison Creek. Since deep percolation and lateral movement of water in this situation is a slow process, the impact of increased yields on cutting Unit 8 may not be manifest for three to five years.

We also walked up into Land Units D and E in the vicinity of cutting Units 5 and 6. This included the proposed road to Unit 5; the deeply incised "V" channels, and the alluvial fans at the terminal end of these "V" channels. The land area above the "V" streams acts like a "Tin Roof" wherein most of the precipitation runs off through the "V" notched stream channels to the stream braided alluvial fan. In the natural situation, water from Land Units C and E normally deposits its sediment on the alluvial fans at the mouth of Unit E. These fans are natural sediment deposit areas, built up over the years. Surface waterflow over the fans is through several defined channels that are continually shifting as more sediment is deposited. If a road is constructed across Unit E (the deep-cut stream channels) a significant increase in sediment production will occur. If a road is constructed across the alluvial fans, a significant increase in sediment delivery to the stream (Puzzle Creek) will occur because the water will tend to be collected and channelized. The greater flows will carry more sediment directly to the stream. The higher up on the fans the road occurs, the more sediment will be carried directly to the stream. Flow rates will also be speeded up, as discussed earlier. (See discussion on slope hydrology.) A direct increase in either the sediment load or the flow rates of Puzzle Creek will be extremely deleterious because the creek is already at capacity for both aspects. An increase in either will cause additional damage to the fisheries and to the streambanks and channel.

If a road is constructed across these fans, the onsite water management objective should be to keep the water dispersed rather than collecting and channelizing it in culverts and ditches.

Puzzle Creek and a short portion of Morrison Creek channels were walked to determine condition and stability. That portion of Puzzle Creek above the spur road to cutting Unit 2 is in relatively good condition compared to the rest of the channels. The lower portion of Puzzle Creek is full of debris from the 1964 flood and from recent avalanches. Fresh sediment deposits are found behind many of the debris jams, and currently active bank cutting was noticed in several places. The portion of Morrison Creek from the bridge on Road 2848 to the junction with Puzzle Creek is also in relatively good condition.

The lower portion of Puzzle Creek could be enhanced by removal of certain debris. This should not be done without due fisheries and hydraulic considerations, nor should it be considered a tradeoff for logging which could affect the stream in other locations.

The stability of the stream channels and banks presents a different picture. The entire bank system of Puzzle Creek is laced with mass failure areas. Most frequently, the slumps occur on the east bank of the creek. These slumps are associated with the subsurface flow as it emerges at or near the creek level. The slumps are aggravated by the continual undercutting of them. Any additional water entering the slump area, either surface or subsurface, will keep them active. Likewise, an increase in the peak flows would cause additional undercutting of the slumps. The slumps have contributed much fine material to the streams system, most of which have settled on the stream bottom. These fines, if much more extensive, could result in the depletion of salmonid reproduction in this stream.

Morrison Creek, above its junction with Puzzle Creek is, again, relatively stable. Some sloughs do occur, but they are due primarily to bank undercutting, rather than by slumping. One critical slump was noted on the north bank of Morrison Creek about 200 yards below its junction with Puzzle Creek. A slump has developed on this bank, immediately adjacent to the stream, which also lies directly below cutting Unit 3 which was clearcut in 1970-71. The increased yields as a result of this cutting may be directly responsible for this slump.

It was also noted that many small tributary streams are located throughout these reaches of Puzzle and Morrison Creeks. Protection of these small streams must also be considered in order to protect the overall spawning of the Dolly Varden.

Conclusions and Recommendations

Our review has led us to the following conclusions and recommendations.

1. The scientific soils, hydrology, and fishery data in the environmental statement has been carefully developed.

2. The soil-hydrology map is of sufficient detail to support their conclusions.

3. Any team or individual planning on review or even visiting the area should read and study the scientific data found in the environmental analysis report before going to the area.

4. Although reference is made to slope hydrology throughout the report, it needs to be more fully developed and strongly emphasized as it is critical to the management of this watershed.

5. We recommend the present road 2848 not be extended through timber sale Units 7 and 8. Both areas contain highly unstable soils and irreparable damage to Puzzle Creek and Morrison Creek in the form of increased sedimentation, erosion of streambanks, etc.

6. We recommend timber sale Unit 8 not be cut. The increased runoff will contribute sediment and cause additional streambank erosion. Deep percolation of water to the underlying limestone bedrock may aggravate the slumping problem in Morrison Creek. We also believe other silvicultural problems will develop. Unstable land areas near the toe of sale Unit 8 has high potential for slumping, adding high amounts of sediment to Puzzle Creek.

7. We recommend a spur road not be built to timber sale areas 5 and 6. A spur road across the slope will create severe slope hydrology problems affecting the areas stability, water yield and vegetative composition.

8. If feasible from a silvicultural standpoint, we recommend timber sale Unit 5 be helicopter logged, removing the older overstory. A team consisting of a silviculturist, fishery biologist, hydrologist, and soil scientist should evaluate timber harvest practices in relation to sediment yield, increased water yield, slope hydrology impacts, soil productivity impacts and the silvicultural impacts.

9. We recommend the spur road across the avalanche paths to, and in, timber sale Unit 2 be examined and management practices such as erosion control be instituted immediately after harvest and before winter sets in.

The Puzzle Creek modification proposal is still under consideration. The final decision will come soon. It is of particular interest because it shows the steps in accomplishing the change. This was a difficult undertaking, but it helped develop the process of review by specialists of the conditions which could contribute to environmental degradation. In the process the specialists and the staff of the Flathead National Forest gained a considerable amount of experience. From this they have developed their present system where the review is made in advance of the sale and the sale is designed to meet environmental requirements from the beginning.

IV. PRESENT PROCEDURES AND ACTIVITIES ON THE FLATHEAD N.F. A DESCRIPTION AND ANALYSIS

A. Long Range Planning

Since 1971, there has been a great deal of change in the way the Flathead National Forest goes about its business of managing resources. There has been a change in the language from Washington and the Regional Office. This was a rhetorical change, full of the spirit of NEPA that focused so much attention on environmental quality. There has been a change in the organization of the Supervisor's staff that has induced a spirit of unity and mutual dependence among the units and the personnel on the Flathead; this was a structural change. There has been a procedural change too, occasioned by the rhetorical and structural changes that have occurred. The procedural change is a renewed emphasis on resource planning as the means for ensuring environmental quality.

The Flathead personnel now see resource planning as the most important thing they do. There is a shared conviction that resource management must be a consequence of sound resource planning, and that the planning must come first. The Forest is spending a considerable amount of its time and energy in resource planning, and is defending that activity jealously, against a number of other claims on its time and resources.

Two elements of the Flathead organization--one tangible, the other not--combine to make the resource planning and management activities work well and smoothly.

The intangible element is the disappearance of the autonomy of the

Ranger District. There are still separate ranger stations, and rangers, and districts, for that matter, but the units do not see themselves as distinct entities. Rather, the entire Flathead Forest is viewed as the operating unit. The Tally Lake ranger is concerned about the Swan Lake District as well as his own. The Rangers, the Supervisor, and the Supervisor's staff constitute a management team, and they all view themselves as team members planning for and managing the Flathead National Forest, not budget-antagonists at the District level. The Districts are subdivisions of spatial convenience, not independent management units. A more concrete expression of this unity is the timber management plan now in force on the Flathead. When the old plan was revised in 1969, the separate working circle boundaries, which coincided with ranger district boundaries, were eliminated, and the current plan relates instead to the Flathead Working Circle--the entire forest.

The tangible element of Flathead organization is the elimination of functionalized specialties on the supervisor's staff. No longer is there a separate staff position for timber, for wildlife, for watershed management, etc. Instead the organization is subdivided into "operations" and "planning" and this format seems to be extremely effective in fostering the sense of management and planning unity for the entire forest. It spawned the "management team" image, and that has blurred the independent identity of the ranger districts; the result is a laudable singularity of purpose and spirit on the Flathead.

The multiple use plan is seen pre-eminently as the basic land management document, fundamental to all others, and there has been a great deal of deliberation and resources invested in it. The Forest Service has been in the planning business for a long time, but since the passage of the Multiple Use Sustained Yield Act in 1960, multiple use planning has assumed dominance among all planning activities. Since NEPA in 1970, multiple use planning and management have been the official vehicles for the Forest Service's concerns and responsibilities in environmental quality. The agency made a deliberate decision to incorporate environmental quality concerns, and environmental reporting procedures (i.e., impact statements, etc.), directly into its multiple use planning processes, and to utilize its multiple use planning resources and staff to accommodate the new responsibilities.

The current multiple use plan for the Forest is called "Flathead National Forest Basic Land Management Plan, 1." It was recommended for approval by Forest Supervisor on December 23, 1971 and approved by the Regional Forester on November 1, 1972. It is important to keep in mind that the planning on the Flathead is not intended to produce static, once-and-for-all answers, but rather to exhibit a process or an approach to land management. The planners see the world this way and it is more accurate to describe the Flathead as a planning forest than as a planned one.

This is a philosophy of dynamic planning, and there appeared to be almost complete consensus about it among the Flathead people. They also agreed on two other major patterns of thought and behavior.

One was the necessity of public involvement in the planning process.

The other was a management rationale that can be described as "localized decisions based on land productivity."

Two elements in the policy-streams from the Washington and Regional offices made a great deal of sense to the Flathead people. One was the repeated emphasis on decentralizing decisions: more and more decisions were to be made "on the ground," and the basis for those decisions was to be "quality management." This meant, to the Flathead people, that management decisions would be constrained by land productivity. Since no one knew better, or could better learn, the limits of land productivity than the local managers, "localized decisions based on land productivity" appealed very strongly as a management rationale.

Some of the procedures in the current Flathead multiple use plan date to the early ones established soon after the Multiple Use Act was enacted--the zoning features, in particular--and others are much more contemporary--the public involvement features.

In July of 1971 the forest personnel held eight "listening sessions" at communities throughout the Flathead Valley, deliberately seeking public comment and expressions of value that could be incorporated into the multiple use planning process. Thus the Flathead looked outward early in its planning activities. It kept meticulous records of the listening sessions, and ultimately published a report entitled, Flathead National Forest Listening Sessions, Northern Region, July, 1971.

In the introduction to that report, the Flathead outlined the rationale of its planning approach. The multiple use plan, the report said, would be the one on which,

> ...all other Forest plans, uses, and activities are based. This basic document involves essentially three component parts: (1) an inventory of the land to produce resources and uses; (2) an inventory of existing resources and uses; and (3) recognition of peoples' thoughts and ideas.

The report also made clear the intent of the public meetings: "These 'Listening Sessions' are a part of component number three."

Paraphrasing the intentions listed above, three planning elements can be identified as follows:

1. an inventory of productivity
2. an inventory of existing outputs (a reflection of current demands)
3. suggestions for marginal adjustment--and expressions of non-market demand

Element No. 1, the inventory of productivity is the most significant and crucial. With that information the Flathead Forest can take the policy initiative, making the independent and professional decisions on management and production that will meet the requirements of environmental integrity promised by the policy streams from the Washington and Regional Offices. Without productivity information, management decisions can only be random--or issued off-site from distant headquarters offices. Scientific, biological productivity data are the only defensible alternative to managing the Flathead by political dictate--to growing timber by fiat, for example. The acquisition of productivity data will be the ultimate test of the validity of the multiple use planning process.

The criterion that will be applied to the evaluation of the resource planning of the Flathead is: How well does the planning effort identify and, ultimately, quantify, the productivity of lands administered by the Flathead National Forest?

After the eight listening sessions had been conducted, the staff assembled the transcripts of the meeting, read through them, and prepared the sizeable document summarizing them. In a section entitled "General Evaluation" the following is found:

> The most common criticism was against the practice of clearcutting. Even those who spoke in support of the practice felt it should be used with much more discretion and concern for other values. Most people said they wanted better multiple use balance on the Forest. Many felt the Forest Service is preoccupied with timber management.
>
> ...Another point expressed by a large number of participants was that we have too many roads.

Thus, the concern for environmental integrity and quality management in the policy streams from Washington was echoed at the local level, and the Flathead people took cognizance of it as they proceeded with their multiple use planning.

On the 8th of October, 1971, the "Flathead Forest Multiple Use Plan Part I" was submitted to the Regional Office for approval. It contained a 23 page appendix that compared the specifics of the plan with the policy streams contained in the Washington office document Framework for the Future document and the Regional directive, Management Direction for Northern Region. The congruence was total and complete, but this version of the Flathead plan was not approved. It was resubmitted December 21, 1971, and approved by the Regional Forester November 1, 1972; the major difference in the two versions was the deletion in the final version of the appendix material comparing the plan, the Framework paper, and the Management Direction. The document was renamed Basic Land Management Plan, 1, and the "1" referred to the first of a two-phase planning effort.

The first phase was the general, overall plan for the management of the Flathead; and the second would consist of detailed management prescriptions for sub-units of the Forest.

The philosophy of "dynamic planning," public participation, and localized decisions based on productivity, was made explicit in the Preface:

> Both Part I and Part II of the Plan integrate three basic components: (1) The ability of the land to produce on a long-term basis; (2) Inventory of existing resources and uses; and (3) Recognition of peoples needs and demands.

This is a recapitulation of the planning elements proposed in the "Listening Sessions" paper: productivity, existing outputs, and provisions for changes. However, the ability of the land to produce is not specified here, except in very broad terms. For example:

> The (general forest) Zone offers the best opportunity to raise timber; it provides almost all winter range for deer and elk available on the Forest; it provides year-round habitat for all but the subalpine animals found in this region; it provides almost all of the domestic stock grazing opportunities found in the Forest; it provides the largest and most influential acreage for water runoff and storage; it provides almost all spawning streams; it provides many streams for domestic water supplies...special uses...insects, disease, wildfire threats...recreation opportunities.

This example passes, in Part I, as an inventory of "the ability of the land to produce on a long-term basis," and is not sufficient as a data-base on which to make management decisions. Part I is designed to do something additional:

> Part I is an analysis of the Flathead's situation--its lands to its users, the local communities, and region. The Forest's land zoning descriptions, situation statements, and assumptions about the future have resulted in Forest management direction statements called Coordinating Requirements. These requirements set guidelines for resolving

> resource conflicts, giving direction, helping in decisions, or setting priorities.

It is apparent from this statement that Part I has very little to do with the sequence of productivity--needs--changes, or with independent management decisions on output quantities. Part I will not and cannot tell the Flathead people what can be done, in a biological sense of land productivity.

Part I is simply the latest in a series of planning documents that stretch back thirteen years to the Multiple Use Act of 1960; the Forest Service at that time, saw multiple use primarily in terms of land use zoning--on the bases of physiographic features--and in terms of ameliorating land use conflicts. There was no attempt to make a scientific inventory of the biological productivity of forested properties--to indicate what could be produced, nor any attempt to assess the market and non-market demands to indicate what should be produced.

With respect to many earlier multiple use plans, there are only marginal changes in this one. It describes the features of the various zones, the water influence zone, and the special zones. Only in the widest definition of the term can these descriptions be considered statements of "the ability of the land to produce on a long-term basis." That much is unchanged from earlier plans.

The next section is both new and intelligent: it is entitled the "Forest Situation," and it is candidly written. The section describes the status, in turn, of "agricultural crops and forage," "game and sport fish," "recreation," "water," "energy fuel minerals," "non-fuel minerals," "wilderness," and "timber." The situations cannot be categorized as easily as the resources can--each was analyzed with discrimination and care--but the most significant information, relative to pollution abatement and environmental quality is found under the discussion of water:

> The importance of water on the Flathead cannot be overstressed yet management practices and development have not always protected the water resource. Resource plans of all types refer to "good watershed management," but lacking was a clear definition as to what was meant by this. Definite watershed management standards, guidance, or water resource objectives were not clearly identified.
>
> District multiple use plans developed in the '60's clearly stated that water quality and quantity should be maintained. The many uses of water were recognized, and water was thought to be important enough to receive special attention and management. However, water was subordinated by other resource activities and uses, and was considered a separate resource entity rather than part of the total environment. Water was considered on a project-by-project basis rather than an environmental or area-planning basis. Consequently, until recently little thought was given to long-range effects of management of the water resource both on-site and downstream.
>
> Timber Management activities have been first priority on much of the Flathead for the last 20 to 30 years. Most of the timber harvesting was accomplished through clear-cutting. Clear-cutting and the related road systems have had a tremendous impact on water quality, quantity, and timing of runoff. On-site damage was considered tolerable in many cases, but accumulative effects which caused downstream damage in several cases were not recognized.
>
> In summary...Plans have not recognized water as related to climate, topography, vegetation, and soils. As a result, the importance of water as part of the environment has been misunderstood. Downstream damage, as well as on-site damage, was accepted as the price to be paid for progress.

The Flathead plan-writers were admitting miscalculations and misunderstandings as a prelude to substantive improvement. This was a candid and honest appraisal of problems to be solved, of practices to be improved, of planning and management activities to be changed. The Flathead is taking at face value the admonitions of the policy streams to act with authority and accountability to do a better job of managing the physical environment.

The next section of the Basic Land Management Plan is entitled "Basic Assumptions" and under four categories one general "assumption" is made. The categories are "Land," "Resources and Uses," "Management," and "People," and the common assumption is "more." This is a typical statement: "The public will demand increased utilization of resources from our limited resource base." All trends are seen as sloping sharply upward--and no new trends or impacts are identified. The Forest was attempting to isolate and identify the assumptions it was making in writing its multiple use plan. If the zoning descriptions were rough and ready statements of productivity, the "basic assumptions" could be thought of as rough and ready statements of demands being made of and on the Forest.

The next section of the Plan is viewed by the Flathead officials as its core: this section contains the "Flathead Forest Coordinating Requirements," some 86 statements of intentions, constraints on resource uses, and management decisions. The coordinating requirements are a vestige of earlier multiple use planning philosophy, in which zoning and conflict-resolution were the objectives. In those earlier plans, they were the mechanism of use-harmonizing within each of the zones. Indeed, four of the five categories of the present plan's coordinating requirements are zone categories. Coordinating requirements are listed for the high area zone, the general forest zone, the special zones, and jointly for the water and travel influence zones. The other category is listed as "General (All Zones)," and it contains 53 of the total of 86 coordinating requirements.

Multiple use planning must go far beyond land zoning and conflict resolution, and indeed the Flathead Basic Land Management Plan, in its section on coordinating requirements, attempts to do so. Only about one-third of the requirements are keyed directly to the land use zones. The other two-thirds are statements wholly in the genre of the Framework for the Future or Management Direction for Northern Region. Here are some examples:

I,D,1: Get involved and participate in outside activities.

I,A,6: Transportation planning will be done in conjunction with basic land management planning.

I,E,9: Base access needs on specific land management purposes.

I,K,1: Formulate plans and programs based on interrelationships among our various objectives and policies, multi-objectives. Express interrelationships, mix or balance among the multi-objectives; production of goods and services, local and regional economic development, and quality of environment whenever possible.

The generic resemblance of these requirements to those in the Framework and Management Direction papers is not coincidental. In the earlier version of the Plan a 23 page appendix compared the three documents statement for statement, and the compatability was conspicuous. It might be said that the Coordinating Requirements are the final link in the policy chain: from Washington to the Flathead Forest the agency promises to do right things and to do things right.

The Flathead officials were both proud of and committed to the coordinating requirements they had written. They meant the "CR's" to be strong, binding, and unequivocal, and a number of inspection reports were reviewed in which managers were severely criticized for violating them. And a number of the "CR's" do appear to have substance:

III,3: Until we know more about the effects of roads and timber harvest on high elevation-low timber producing areas, allowable cut adjustments will be made as these areas are identified.

III,11: Avoid or modify harvesting in drainages involving unacceptable watershed degradation, either existing or anticipated, based on hydrologic analysis.

III,12: Revised Timber Management Plan on basis of known hydrologic and wildlife limitations, as well as changes in the land base and marginal areas.

I,F,1: Revised allowable cut timber volume excluding contributions from wilderness candidate study areas. Determine future timber harvest in other roadless areas through land management planning.

And at least two of the "CR's" seem to have been written in direct response to the general evaluation of the "Listening Sessions." The complaints therein centered on clearcutting and road frequency, and the CR's deal with those complaints as follows:

III,1: Do not clear-cut where alternative cutting methods are feasible unless clear-cutting must be done to achieve management objectives set forth in the Multiple-Use Plan.

I,E,11: Re-evaluate present transportation systems with the objective of closing roads that are not continuously needed for the purpose for which they were constructed.

(This, presumably, is a result of the expressed complaint about road frequency.)

The "CR's," viewed comprehensively, seem to be a compendium of caveats, vague constraints, aspirations to virtue, and evidence that the Flathead planners were familiar with the Framework and Management Direction pamphlets. There is not much to be found in them that is extraordinary, exciting, or even very unusual: they might apply with equal facility to any National Forest. If one reads carefully, however, one senses a certain continuity. The CR's do contain the conviction that independent production decisions would be made locally, and they would be made on the basis of land productivity.

The "CR's" do not lead to the kind of productivity information the managers will ultimately need. Part I of the Basic Land Management Plan was not designed to do that. The "area plans" that would comprise Part II are to do it, and the final section of Part I scheduled that phase of the planning activity.

The Planning Unit boundaries were delineated by a forest multiple-use task force consisting of the forest planning officer and representatives and/or rangers from the various districts. Once the boundaries were established, a "planning level" was determined for each unit; Level I planning would involve much new inventory information, Level III would rely on existing data, and Level II was intermediate. Finally, the planning unit priorities were agreed upon, and four units were ranked in order for Level I planning: the Spotted Bear River unit; the Lake Five unit; the Tally Lake unit; and the Stoner Creek unit.

Clearly, an enormous responsibility was attached to unit planning; through years of controversy and conflict about forest management practices; through hours and days of Congressional hearings; through comprehensive studies both within and without the Forest Service; through policy studies and declarations constituting hundreds of pages and thousands of man hours, the Forest Service had come to recognize a problem and to formulate its solution: management decisions would be made independently at the Forest and District level, on the basis of land productivity, and in unit planning that information would be secured.

The highest priority plan for the Forest--the Spotted Bear River Plan--was released on February 27, 1974. It promised to "integrate three basic components: (1) The ability of the land to produce on a long-term basis: (2) Inventory of existing resources and uses; and (3) Recognition of people's needs and demands." The plan's success in meeting this central objective is not obvious, particularly as it doesn't even attempt to address the second and third "basic components."

The plan bears no direct boundary relationships to the zones in Part I nor to the "CR's". There is no market-analysis contained in it, nor analyses of non-market demands made of the unit. And there is no explicit concern for air and water pollution.

Planning is time consuming and demands up to 50 percent or more of the time of most of the specialists at the Forest level. The effectiveness of the planning process can be questioned, but, based on the comments of the specialists, one can assume that they are qualitatively better than they were several years ago in terms of knowing how to plan and in attempting to reduce degradation of non-timber resources. While the specialists often expressed the need for more information, particularly specific quantitative information, they did have confidence that the planning process would provide guidelines for the Districts that would improve the quality of management on the Forest. As will be noted in the Lower Sullivan Creek case study, (Page 104) if a District is already committed to a given procedure on a project area, the specialists seem inclined to work with the constraints of that previous commitment.

Because of the limited data available it might be useful to accelerate data gathering even though it might mean temporarily slowing the planning process at the Forest level. Much needed data probably can be obtained with a concentrated effort so that planning could become more meaningful. Effective planning is dependent upon trained decision-making experts as a part of the planning team. Also, it is essential in the process itself that the team include a skillful integrator to effectively determine and consider the environmental information that must be gathered on any intended management unit.

For both air and water quality, it is important that planning be by hydrologic units or drainages as stated in the clearcutting memorandum of March 23, 1973 from the Regional Forester to Forest Supervisors. Planning by drainage areas with adequate information on the effects of any manipulation on small basins, should prevent concomitant management practices on several units resulting in changes which exceed (1) threshold levels of stability for the major forest area or (2) environmental quality standards previously established. Prediction of changes within larger basins would be possible by using lower order (e.g., second order) watersheds as detailed planning units. Watershed planning should allow for management units encompassing several or parts of several of these small watersheds. Despite some problems in adopting the hierarchical watershed approach to multiple use planning,[1] their usefullness both in predicting and determining changes in water and air quality seems clear and has been advocated at the regional levels (Marks, 1971).

In summary, the efficacy of the planning effort itself must be questioned. Although identifying potentially hazardous areas and stratifying land uses in the forest areas in some detail is significant, the degree of time investment in this particular process, given the results presently obtained, may be too great. It seems that the planning process is running ahead of the data.

Once again the error here is one of execution, not concept. The planning goal of the Flathead is above reproach, namely: to determine, through resource planning, both what the land can produce and what the social needs and wants are, expressed in both market and non-market terms, and then make local independent production and management decisions accordingly.

The Flathead officials appear committed to the right things--planned management and quality management. They face both constraints and reality, and the conflict is sizeable between their aspirations and their possibilities. For example, Coordinating Requirement I,A,2 states this: "Determine future land uses through area planning rather than through special resource planning." That statement has been approved by the Supervisor and the Regional Forester, and yet timber management planning occupies a sizeable amount of time on the Flathead. The forest expects to spend 18 months and almost $200,000 writing a new timber management plan, in seeming contradiction to the CR above. The Supervisor and his staff might better spend that money on area planning, and indeed intend to integrate the timber planning effort directly with their long range planning activities. The Flathead can spend the timber management planning funds wisely, since the allowable cut figure determines the magnitude of timber harvest activities, and that is presently the single most significant determinant of air and water pollution.

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[1] Problems which must be addressed before such a system can be developed include (1) the non-existence of a widely accepted description of a first order watershed (R. J. Shreve, personal communication); (2) the existence of adventitious watersheds and portions of higher-ordered drainages which are not accounted for by included lowered-ordered basins; (3) the need to use different scales when considering different resources; e.g., wildlife versus water (J. L. Lyon, personal communication); and (4) the possibility of over-emphasizing the biophysical aspects of the resources to the detriment of social and economic values with over-enthusiastic adoption of such a procedure (E. Corpe, personal communication).

B. Level of Timber Harvest

It is quite clear that some air and water pollution is occurring on the Flathead National Forest. The amount and significance remains largely undetermined at this point. But one thing is obvious, most of the pollution results from timber operations and road building (and most of the roads are built to facilitate timber harvesting). Thus, leaving aside the issue of how serious the pollution might be, the fact remains that there is a strong positive correlation between the level of timber production and the amount of pollution. Not all timber operations cause pollution, but most pollution is caused by timber-related operations. Furthermore, most other incidents of environmental degradation (e.g. damage to fisheries and wildlife habitat, aesthetic deterioration, spring floods, etc.) are likewise associated with timber-related operations.

It follows then that the amount of timber cut each year is a matter of vital interest to anyone concerned with the quality of the natural environment on the Flathead National Forest. The higher the level of annual harvest, the greater is the potential for environmental damage. Also, a high level of cutting increases the risk of serious (or even catastrophic) environmental damage; it tends to divert managerial attention and resources from non-timber activities; it diminishes the land use options available in the future; and if the level of cut cannot be sustained it can cause serious social and economic disruptions at some time in the future. The degree and seriousness of the impact of high cutting levels is not known in a quantitative or specific sense; but the burden of proof is on those who advocate the higher cutting levels. The thrust and spirit of the new environmental laws clearly requires evidence that damage will not occur before an action is undertaken--rather than allowing an activity to proceed in the absence of proof that environmental damage will result.

However, it would be naive and unrealistic to argue that the cutting level should be drastically reduced (or eliminated) in the interest of protecting the environment. Our society needs wood products, and the economy of the Flathead Valley is heavily dependent on the wood products industry. Furthermore, with proper supervision and the use of the proper equipment and methods, a substantial amount of timber can be harvested without causing serious pollution or other environmental damage. And, with adequate investments and good management it should be possible to increase the level of cutting over time without compromising the environment.

So what is needed is a compromise; a cutting level that will provide a reasonable supply of timber to our wood-using industries and to the consumers of wood products, but that will also prevent serious damage to the natural environment. The question becomes: How do we arrive at this compromise cutting level?

Description of the Present Situation

The Flathead Forest is presently operating under a Timber Management Plan approved in 1969. This Plan originally set the annual allowable cut at 194.6 million board feet. In 1970 this was reduced to 181.6 million feet because of the moratorium on cutting in the Middle Fork of the Flathead River, (an area being studied for potential classification as a Wild River). Over the past several years the actual harvest on the Flathead has averaged about 151 million board feet per year.

In 1972 the Flathead Forest Supervisor decided to propose a modification of the 1969 plan. Based on a new reclassification of the land, consideration of new environmental constraints, and the use of a new method for calculating the annual allowable cut (now called the programmed allowable cut), the Forest proposed a reduction in the level of allowable cut to 119.4 million board feet (plus a small portion of 26.9 MMBF that might be available from marginal land). This is a proposed reduction of 34-percent. Furthermore, the 119.4 MMBF figure includes the expected yield from 7 to 9 inch logs which was not included in the 1969 plan. Much of the reduction (26.9 MMBF) is due to the reclassification of 203,780 acres of land from "industrial" to "marginal". The timber on these "marginal" lands is not considered available with today's markets and with existing logging technology. Another change that required a reduction in allowable cut was the addition of 73,600 acres to the "high area zone" (i.e. from 261,000 acres to 334,700 acres). Land in this classification is considered non-commercial and it is excluded from the timber growing base when the allowable cut is calculated. Certain "roadless" or undeveloped areas were also temporarily removed from the timber growing base, pending studies that would determine whether they should be developed or permanently designated as Wilderness. Also accounting for part of the reduction in allowable cut was the decision to extend from 32 to 50 years the period of time allowed for liquidation of mature timber.

This proposal to reduce the allowable cut was met with some dismay by the timber interests. The controversy that ensued is still being pursued. The outcome is vitally important because of the intimate correlation between the amount of cutting and the potential amount of pollution.

How is the Annual Allowable Cut Determined?

It might seem, at first thought, that allowable cut (annual yield) is a rather simple concept, and its calculation would be a rather straightforward process. One would simply determine the acreage of land available for timber production, inventory the standing volume, estimate future growth, and then schedule the annual cut to achieve the predetermined goals of a forest. In practice, however, the process becomes complex and frustrating. Goals are usually vague and often conflicting; adequate information is usually lacking (on such things as growth, environmental impacts, responses to cultural treatments, etc.); economic and technological factors are variable; social and legal contraints are changeable; and even the definition of a forest is in question (in terms of species, tree size, location, extent and density of the stand, etc.).

The Forest Service has evolved a logical, though very subjective, system. They start by dividing the land base into two categories; timber growing land (942,339 acres on the Flathead National Forest) and land not available for timber production (1,423,027 acres on the Flathead). The latter category includes non-forest (roads, rocks, water, etc.), dedicated Wilderness areas, non-commercial forests (e.g. alpine or high elevation forests), and land set aside for special studies (e.g. wild and scenic rivers, roadless areas, etc.).

The timber growing land base is then further stratified into three additional categories:

1. Standard (692,319 acres on the Flathead)--land where timber can be grown and harvested with existing markets and logging technology.
2. Marginal (203,780 acres on the Flathead)--land where timber cannot be economically harvested with existing technology without causing unacceptable damage to other resource values.
3. Special (46,240 acres on the Flathead)--land where production and harvest of timber must be somewhat curtailed in order to protect special recreational or scenic values (e.g. roadsides and water influence zones).

An allowable cut is then calculated for each of these categories;

usually stratified further by species, size class, cutting method, etc. Actually, two kinds of allowable cut figures are determined for each category:

1. The Potential Annual Allowable Cut--the biologically possible allowable cut, considering land capabilities and assuming optimum Management.
2. The Programmed Annual Allowable Harvest--that portion of the potential annual allowable cut which will be offered for sale each year during the planning period; usually lower than the potential because of inadequate funding, manpower, technology, and the need for protecting other resource values.

On the Flathead National Forest the actual calculations which determine the allowable cut are performed by computer, using the Timber RAM model devised by the Pacific Southwest Forest Experiment Station.

The Timber RAM model has been thoroughly described and evaluated elsewhere.[1] It is essentially a linear programming model that determines the best cutting schedule for achieving specified objectives. It optimizes an "objective function" under a set of designated constraints. For example, it can be used to determine the cutting schedule that will (1) maximize the volume yield during the first decade of a planning period, (2) maximize the present net worth of the forest property, or (3) minimize the cost of managing the forest property. Region I of the Forest Service usually uses an objective function that maximizes the volume production (i.e. the cut) over the full plannning period (usually 1 1/2 rotations).

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[1] Navon, D. I. 1971. Timber RAM...a long-range planning method for commericial timber lands under multiple-use management. Pac. SW For. Exp. Station, USDAFS paper, PSW-70.

The constraints that limit the cut (or which influence the cutting schedule) can be classified into three categories:

1. Biological constraints--such as total standing volume, age class distribution, projected growth rates, soil and hydrologic conditions, etc.
2. Technical constraints--such as harvest methods, silvicultural treatments, rotation length, utilization standards, regeneration period, rate of roading for accessibility, etc.
3. Policy constraints--such as "even-flow" requirements, conversion period (i.e. liquidation of old growth), rate of progress towards a regulated forest, assumptions about future intensity of management, tradeoffs between timber and other resource values, etc.

The calculation process proceeds as follows: (1) a single objective is designated, (2) all of the pertinent constraints are identified and specified, and (3) the computer (using the RAM program) finds the cutting schedule that best meets the objective without violating any of the constraints.

The system appears reasonable and rational. However, because of inadequate data, subjective technical judgements, and policy assumptions the results (i.e. the calculated allowable cuts) are subjective and difficult to defend. The planner or analyst can almost literally get any answer he wants. This is not necessarily bad, but it is a fact that must be acknowledged.

it should also be pointed out that the most influential factors in the process are all under the control of the forest manager or planner. Thus, even on the basis of much better biological and technical data, the cutting level could still be greatly influenced by adjustments in policy or assumptions about the future.

Is the Forest Service Justified in Proposing a Reduction in the Allowable Cut?

The Forest Service is required by law to provide for the sustained yield of all forest resources in perpetuity, without impairment of the productivity of the land or degradation of the natural environment. This is, by design and intent, a conservative policy. Therefore, the proposed reduction appears prudent and wise. To attempt to justify a higher allowable cut by arguing that timber is more important than the other resources, or on the grounds that markets, technology, or management intensity may improve in the future, would be to subvert the laws that were established to guide the management of the National Forests. Some specific reasons in support of a conservative policy are as follows:

1. Knowledge about the forest ecosystem, about the impacts of cultural treatments, and about the economic implications of forest policies and practices is rudimentary at best and in some cases almost completely lacking. Until such time as these inadequacies are overcome it would seem prudent to be conservative when making important management decisions.
2. Many professional foresters on the Flathead were convinced that the present cutting level was too high. One ranger estimated that he had enough timber for only five more years;

another said he could continue his present cut for only 10 more years. A specialist in the Supervisor's Office estimated that the present cutting level could only be maintained for about 30 years, and then it would have to be reduced substantially. Several of the technical specialists told us that they were confident that if they had better data in their area of responsibility it would suggest that the allowable cut should be reduced. This evidence is subjective but it is meaningful because it is consistent and it comes from knowledgeable people who have an intimate association with the Flathead Forest.

3. There is reason to suspect that many of the non-timber resources are not being managed on a sustained-yield basis. In response to a direct question concerning the sustained flow of their resource, most non-timber specialists responded either that sustained yield was not being practiced or that they had no basis for making a judgement. Until all other resources are put under sustained yield management, as required by law, the timber resource should be managed conservatively to prevent the foreclosure of future options.
4. A review of NEPA and subsequent environmental laws leads to the conclusion that the Forest Service must regard environmental quality as an objective (goal), not simply a constraint on the achievement of other goals. In other words, the Forest Service must actively work to maintain and enhance air and water quality, just as it works to maintain or improve

the yield of other products and services from the Forest. Prevention of pollution is in every sense a coequal goal with the harvest of timber. Thus, it is no longer sufficient to say that unless potential environmental damage can be proven, a forest practice may be undertaken. The burden of proof has shifted. Now the practice should not be undertaken until it can be proven that environmental damage will not result. This new national policy suggests that the annual allowable cut should be as conservative as possible until we more fully comprehend the environmental impacts associated with timber cutting.

5. Most of the arguments for increasing the allowable cut are misleading. For instance, it seems unwise to increase the cut in anticipation of more intensive management in the future. There is no reason to believe that Congress will appropriate the necessary funds, or that they would be allocated to the Flathead even if they were appropriated. Furthermore the anticipated growth responses to more intensive management are by no means proven or assured. It also seems unwise to put much faith in improved utilization, or higher prices, or new technology that will permit the harvest of timber in "marginal" areas. These things may develop, and if they do, the cut should be adjusted accordingly; but in the meantime the allowable cut should be kept at a conservative level. As a matter of fact there are some reservations about the ability of

the Forest to maintain even the reduced level of cut. The proposed allowable cut of 114.6 million board feet includes trees as small as 7 inches in d.b.h.; it presupposes that 8200 acres of precommerical thinning will be conducted each year; and it includes an annual harvest of 4.2 million board feet on "marginal" land. Considering the historical and current performance on the Forest, one must be very optimistic indeed to assume that these practices will be accomplished as planned.

6. The 50 year conversion period (for cutting the remaining old growth timber) is much more practical and reasonable than the 32 year period associated with the earlier and higher allowable cut. It permits a more gentle, gradual treatment of the land, which in turn provides a buffer against unexpected but potential damage to watersheds. It allows more time for the development of better scientific and technical knowledge, which will assure maximum protection for the environment and other resources when the timber ultimately is cut. It prolongs the consumption period for this unique resource (old growth timber), for the benefit of a future generation. It helps to provide an easier and quicker transition to a regulated forest condition. And, finally, it avoids the need for an accelerated roading program, with all of the environmental dangers and problems that are inherent in such a program. It should also be noted that the Forest officials consider it impractical and unfeasible to gain

access to all of the old growth timber in less than 50 years; based on projections of past and present roading accomplishments.

These reasons, while partly subjective, appear to support the Forest Service position to reduce the allowable cut. While there is agreement with the reduced allowable cut, it is not necessary to reduce the cut to that level in one fell swoop.

Weaknesses Relative to the Calculation of the Allowable Cut

The Flathead National Forest appears to have arrived at a reasonable allowable cut. This conclusion is based on extensive interviews, observations, and analyses. Questions regarding the process are illustrated by the following points:

1. Growth projections(which are extremely important in the calculation of allowable cut) are inadequate. For example, it appears that growth on all regenerated stands was projected to be 516 board feet per acre per year...apparently disregarding the effects of site quality, stocking levels, insects, etc. This is unrealistic, and possibly misleading. As another example, in 1969 the Flathead estimated growth in immature sawtimber stands at 231 board feet per acre per year. In 1972 they reduced this to 160 board feet, without any explanation and apparently without any empirical justification.

2. The Forest Service concern with even-flow seems inconsistent. In calculating the allowable cut it insists on a rigorous adherence to a policy of even flow, permitting only a one-percent drop in the allowable cut at the end of each decade. This is done in the interest of maintaining community and industrial stability. But at the present time they are promoting an abrupt reduction of major proportions, i.e. 34%. To most observers it would appear to be an inconsistency in policy.
3. Information concerning the impacts of forest practices on the environment is lacking, and efforts to gain such information are minimal. The Forest has added technical specialists to its staff and these people seem competent, dedicated, and hard-working; but they are spread too thin, they are seriously underfinanced, and they have little opportunity to attend professional meetings, consult with scientific colleagues, or otherwise expand the level of their technical competence.
4. The initial classification of land on the Forest is a vitally important step in determining the allowable cut, but the public seems to have little understanding regarding the process, methods, or procedures for doing this job. What are the operating criteria? Who did the classification? What level of accuracy or precision was required? Were field checks conducted? Full disclosure on this issue, would be to the benefit of the Forest Service and the public.

5. The allowable cut is based, in part, on the inventory of standing volume in the forest. The allowable cut designates how much of this standing volume may be harvested each year. The magnitude of the cut is measured in terms of the scaled volume of the actual logs removed from the forest. The discrepancy between standing volume and scaled volume can be quite large. According to U. S. Forest Service Research Paper INT-77 (1970) the actual volume removed (measured in cubic feet) is only 86% of the standing volume. Thus, to achieve a harvest of 1,000,000 board feet we must deplete our standing inventory by 1,164,000 board feet. Or, to put it another way, by using scaled volume to measure harvest after the allowable cut was based on standing volume, the Forest would be overcutting by 16.4%.
6. The Forest apparently made no economic analyses at all in determining the optimum allowable cut; no cost studies, no economic impact studies, no evaluation of investment alternatives, no cost/benefit analyses, etc. Economics is a vital part of the allowable cut and should not be ignored.
7. Inviting public review of a full blown management plan, with its designated allowable cut, is both difficult and largely ineffectual. The public can have no meaningful input at this point. It would be much more productive to involve the public (in the form of special interest groups) in the formulation of underlying policies, such as even-flow, conversion period, rate of roading, land classification criteria, etc. With

general agreement or understanding on these issues, the calculation of allowable cuts and timber planning in general becomes a more rational processes.

Conclusions on the Subject of Allowable Cut:

Based on an extensive review of all available documents relating to the timber inventory and timber planning on the Flathead, and on field observations and interviews with dozens of knowledgeable people, the following conclusions were reached:

-- some drainages and some planning units on the Forest have been overcut in the past.

-- the allowable cut established in 1969 was too high; or at least it must be considered too high today in light of the many new constraints on the level of timber harvest.

-- proposed level of cut, 119.4 million board feet per year, seems reasonable or at least acceptable; but it may still be on the high side if it is assumed that the present level of management will perisit.

-- the Flathead is basically a very productive Forest and with increased levels of capital investment and good management it should be able to produce timber at a much higher rate.

-- the opinions stated above are intentionally cautious, and conservative to compensate for the lack at knowledge about potential environmental impacts. More knowledge (e.g. a good watershed monitoring system) would almost surely obviate the need for conservatism and might well lead to a recommendation for an increase in the level of the programmed allowable cut in the future.

C. Air Quality

The Forest Service in recent years has prepared written policies regarding dispersal of smoke from slash burning. Title 5100 (Fire Control) of the Manual includes instructions on Prescribed Burning plans (5153.13). Region 1 Supplement No. 48 provides that in order to insure "minimum impact on air quality...employ the principles contained in...'Principles of Smoke Dispersion from Prescribed Fires in the Northern Rocky Mountain Forests,' by W. R. Beaufait and Owen Cramer." (see appendix)

The Flathead contributed to the development of the Regional system and has set directions of its own for prescribed burning, fuel management planning and treatment guides.

The staff of the Flathead forest is concerned with air pollution in several ways. Slash burning is carried out under the present inter-agency agreement described earlier. Many burning areas are near smoke sensitive areas such as Glacier Park, the Flathead Valley itself, and outlying areas such as the Bob Marshall Wilderness Area. Several methods of slash burning are being utilized: hand pile and burn, dozer pile and burn and broadcast burn. About 6500 to 7000acres are burned on the Flathead Forest each year. About 1200 acres are broadcast burned, about 5300 acreas are dozer piled and about 500 acres are handpiled. Dozer piling has been emphasized in order to meet the requirements of the inter-agency agreement. In some areas where it is determined that the accumulated slash is not a serious fire hazard burning is not used. Dozer piling is used in areas that are not too steep and where scarification is needed for seedbed preparation.

Some steps have been taken to develop alternative methods of slash disposal as recommended by the State Department of Health and Environmental Sciences. Several places were observed where the timber sale required removing all trees to a three-inch top. In addition trees were skidded full length to a landing, topped and delimbed there. The amount of slash left by this process was considerably reduced. The accumulated slash is then either piled and burned or burned in an "air curtain destructor".

In another operation a slash cutting machine, called a Tomahawk, was run over the slash to chop it up and incorporate some of it into the soil. In some areas this machine reduced the slash on the site and burning was not necessary. This method had the further advantage of preparing a seedbed for the next crop of trees. It partially scarified the site but also left the soils protected with the broken down slash. This process is still in the experimental stage but for some sites, at least, appeared to offer a viable alternative to slash burning and for site scarification as well.

Main haul logging roads in many areas have been given an oil coating to reduce or eliminate air pollution from dust. Before oil treatment the dust pollution problem was serious and complained about especially in recreation areas. Another problem of water pollution from the oil has appeared. Fisheries biologists have complained of oil pollution in some of the trout streams. Two of the oiling trucks accidentally overturned in streams. In addition run-off and road maintenance have allowed some of the oil to get into streams. The Flathead staff are well aware of these problems and are seeking ways to avoid a recurrence.

At this time it seems that the standards of the burning agreements are being met in most cases. Weather changes and fires that continue to burn after their expected life have caused some problems. Given time, alternative processes for slash reduction may well take care of a considerable amount of the slash disposal. A new problem of slash disposal in partial cuts and in areas being thinned commercially or precommercially is requiring some new measures. They are recognized as posing additional fire hazard due to increase in fuel accumulation.

It appears that for some time into the future there will need to be burning of accumulated slash to reduce the danger from wild fire and to restore fire to the forest at least in part of its natural role.

D. A Review of the Environmental Impact Statements on the Revised Timber Management Plan and on the Three-Year Projected Road Development Plan

During the past year the staff of the Flathead Forest prepared draft environmental impact statements in connection with their timber management plan. The draft for the revised timber management plan was circulated for comment and preparation of the final statement is about complete. The final statement for the three year road program has been issued. The draft was circulated earlier and many comments were received which are attached to the final report.

These two statements are reviewed here to describe where the Flathead Forest is now in environmentally sound management. The discussion of environmental effect is reviewed first and followed by the discussion of the level of timber harvest.

Environmental Effects

In keeping with the Forest's approach to long range planning the environmental impact statements were very broad and general. The statements are meant to give "broad direction" only. These are meant to be followed by an environmental analysis for each operation one to two years before the contract is let. In addition the impact statement promises that if the analysis shows that there will be a major environmental impact, "an environmental impact statement may be prepared prior to advertisement."

Environmental impacts are mentioned broadly in various categories. Impacts on water are recognized as: increase in yield and temperature, accelerated runoff, surface erosion, siltation of streambeds, degradation of channels. Primary impacts are from road construction. "Significant increase in stream siltation often results during soil disturbance phases of road construction." This, in turn, reduces fish habitat. "Transitory impacts on air quality," are also recognized from slash burning. "Once the old growth stands have been harvested this problem will largely be resolved" when "replaced with healthy, vigorous trees."

The prescriptions for mitigation of environmental damage are also quite broad. They include: lengthening the conversion period of old growth, leaving unharvested "filter strips" along streams, greater care in road construction and provision for drainage protection, review by specialists before construction, avoiding construction when soils are wet, avoiding areas subject to mass failure, "defer logging if present techniques cannot protect soil," modify site preparation, and road design all give broad, general but unspecific precautions for which no criteria are set. The Forest

Coordinating Requirements are referred to as the basic document influencing timber harvest and road construction.

Favorable environmental impacts emphasize the economic benefits of timber manufacture, the material for housing needs and some additional access for recreation. Favorable effects on water include: increased water yield although it "must be regulated to avoid the run-off capacity of the individual drainages"; and increased water temperature because it creates "conditions favorable to increased plant growth." However, "precautions must be taken to avoid increasing water temperatures to the point that they become detrimental to desired fisheries. The value of the water produced on the Flathead Forest is said to be $5,000,000.

The principle favorable impact on air mentioned is that "the production of oxygen will increase" as the over-mature stands are replaced with healthy young stands. Danger from wildfire as well as the need for slash burning will be reduced.

A large share of the adverse effects listed are visual impacts because they have been the main topic of public criticism in the past. The only irreversible or irretrievable commitment of resources listed is the loss of the "pure, natural character" and its possible reclassification as wilderness. But these effects will be minimized in keeping with the Regional Forester's Management Direction of March 1972: "timber harvest areas will be designed to produce a natural-appearing landscape. Timber programs should be designed to contribute to other resource enhancement, such as wildlife and recreation."

In discussing the relationship between short-term and long-term effects the statement says: "The potential long-term productivity of the Flathead National Forest depends on maintaining the inherent soil capabilities without impairment of productivity, maintaining the high quality of the air and of the surface and ground water resource." It promises that "road construction will be implemented so as to maintain long-term soil productivity...though 700 acres will be seriously affected." "Road construction will be controlled to insure that the quality of the air meets or exceeds current State and Federal standards. There will be short term lowering of air quality due to construction." "The quality of water will remain high...Every effort will be used to insure water quality continues to meet or exceed current State and Federal standards."

Comments from Federal and State agency representatives emphasize what they called the inadequacy of the statements, that they were too general, gave no specific information and, in fact, provide no measure for judging the environmental effects. "Studies should be cited to indicate the magnitude of increased soil/water run-off, water chemistry changes, and water temperature modifications." "The total effects of an increased and improved transportation system deserve complete and detailed evaluation." "Other economic considerations should be evaluated as well as the timber resource." "Monitoring water quality before, during and after projects is important to determine the effects and to prevent serious long-term problems. Methods and plans for monitoring should be discussed in the final statement. Because several factors affect sedimentation potential from roads (steepness of slopes, soil types, vegetation types and condition, size and location of roads in relationship to streams), these factors and associated alternatives should be evaluated." "The entire impact statements are fraught with unsubstantiated comments designed to provide an after-the-fact justification of the forest's timber harvest goals."

The Forest Service replies pointed out that "detailed comments could not be answered due to the broad nature of the Statement...details will be provided in land use allocation statements and proposed project statements."

Industry favored the statement although one man suggested the need for supporting data. The Chamber of Commerce generally considered environmental concerns and provisions as expensive frills. Citizen groups generally responded that the statement was too general for comment.

Both environmental impact statements, one on timber, the other on roads, were broad and general with the promise that more detailed statements would be prepared when specific work would be undertaken if environmental degredation were threatened. There is a serious lack of guidelines for these specific projects. There exists no body of knowledge to provide such guidelines. Research has provided only a few results which might be applicable. There are no benchmark areas established to measure change in the area. There has been no monitoring of past experience to provide data. The information is not available to prepare specific environmental statements on the projects which might later be undertaken under the umbrellas offered by these two impact statements. The solution to this problem is to develop the knowledge as rapidly and as soundly as possible.

Although the statements emphasized the fact that they were meant to give only broad guidelines and that specific information would be provided in each individual contract, there should be at least general guidelines based on specific data. The promise that specific information will be provided later cannot be fulfilled because the specific knowledge needed is not presently available and little attempt is being made to make the knowledge available.

The lack of knowledge is perhaps most conspicuous in the range of alternatives proposed. With more accurate knowledge a continuum of cause and effect relationships could be shown and the development of alternatives could document the consequences of the alternatives. The alternatives given show one or two irrational alternatives by which to compare the desired alternative. However, there is no proof presented that the alternative selected is necessarily in the rational range for decision or that there may not very well be a better one available.

E. The Specialists

The addition of specialists to the supervisor's staff is generally regarded by the Flathead Forest staff as one of the most necessary and effective steps toward environmental management. The study team spent time with specialists, examined the work and reports of the specialists and discussed their problems with them. Observation was made of how they worked, what they provided, how they felt about what they were doing, and what improvements and changes they thought necessary.

The specialist staff available to the Flathead N.F. includes a soil scientist, a hydrologist, two silviculturists, a landscape architect, a transportation engineer, (all full time) an engineering geologist, a fisheries biologist, and a wildlife biologist (shared with another forest).

The disciplinary diversity of the small specialist staff on the Flathead is impressive, particularly when the importance of having specialists at the Forest level was not recognized until recently. Other Forests (e.g. Bitterroot and Kaniksu) in the Region have and are developing similar teams.

No one on the Forest feels that there are enough specialists available. They cannot spend time on inventory or monitoring, and they can seldom go back and inspect past activities unless serious problems develop. In addition to the staff on the Forest some help is available from the regional office, and from the Fish and Game Department, the Soil Conservation Service and others. Comparing present activities with the past, it is obvious that acquiring and using scientific information is a big step toward more responsible environmental management of the Flathead National Forest.

Specialist's Responsibilities

While most of the specialist's time is assigned to development of the long range plan, they do work on specific problems on the districts. The ultimate intent is to have them examine these problems in a multi-disciplinary analysis prior to activity. At present, most major project (i.e. road construction and timber sale) investigation is limited to those which forebode possible problems to the District staff based on their previous experiences. According to the specialists, on-ground examinations are made on perhaps 10 per cent of the Forest's projects, with this percentage varying by District. These on-ground examinations themselves vary in their thoroughness and are influenced by the number of specialists involved, the time that the specialist or specialist team invest in the analysis, and the amount of data available for a given area. It was apparent that, by necessity, some ground level examinations were not thorough. However, besides examining projects on the ground, the specialist team utilizes aerial reconnaissance (particularly, photographs), existing bedrock information and topographic maps to predict potential problem areas on an extensive basis. The specialists were confident that the extensive analyses are very useful in partially alleviating the development of new problem areas and that in this way they do have the opportunity to at least call attention to potential environmental problems.

Without exception the specialist recognized that the Flathead is in the timber cutting business. They also recognized the official commitment of the Flathead to multiple use but only in relationship to the principal goal of meeting the timber harvest goals. All of the specialists seemed to have accepted the situation as the framework within which they had to work.

They did believe, however, that within these limitations they were effective in the decision process. They pointed to instances where their work had modified road and harvest plans. In one case they felt that their recommendations had stopped a sale. They felt that they had strong backing and were expected to make strong and factual recommendations. The supervisor and his staff confirmed this and felt that they had made it plain to all the Forest staff as well as the specialists that this freedom on the part of the specialists was most important and had to be encouraged.

Problem Areas Noted By The Specialists

The specialists feel that most of the environmental problems relating to timbering activities are caused by roads. Those caused by timber harvesting itself seem less in degree and extent. The most serious problem is mass failure caused by soil instability, slope hydrology or a combination of both. Next in importance is sedimentation. Another problem is channel degradation brought about by increased streamflow as a result of timber cutting. Effects of sediments and organic matter in streams and their effects on fish migration and spawning are of special concern to the fisheries biologist. Also of concern is increased water temperatures in streams where the timber has been cut, or from run-off from exposed areas. Of particular importance to the wildlife biologist are the effects of roads and harvest on animal movements and populations. Another problem is productivity. Establishment of regeneration, particularly spruce in high elevations, and unexplained slow rates of growth of young trees are of special concern.

All these problems are interrelated and interconnected and the communication and cooperation of all the specialists is basic to problem identification and analysis.

They agree that the worst erosion comes from slumps and slides caused by roads and from bank cutting on streams and rivers as the result of increased flow. However, they recognize that there is also a considerable amount of natural sedimentation from normal snowmelt and rain, especially the spring run-off. There are also occasional serious floods such as that in the spring of 1964 which gutted every natural channel including those in the Bob Marshall Wilderness where there had been no road construction or timber harvest. The streams are just beginning to heal from that flood. As a consequence, man-caused activity has a potential for retarding recovery.

A great deal of the adverse effects of road construction can be eliminated if roads are properly layed out and adequate drainage provided. One concern is over the amount of a drainage that can be safely cut at one time and how long it is necessary to wait before it is safe to go back into a drainage for another harvest.

One of the problems the specialists face is that about 200 miles of new roads are built each year. It is difficult to keep ahead. But in addition, there are more than 2,000 miles of old roads, many of them poorly layed out, which need maintenance or perhaps need to be "put to bed"; the specialists haven't time to review that backlog.

Soil scarification has been a standard silvicultural recommendation to provide a seedbed and to reduce competition for tree regeneration. Its use, particularly with clearcutting has left the soil in almost a plowed and cultivated condition. On steep slopes with erodible soils the effect on erosion and siltation could become serious. On the advice of specialists the amount of scarification is reduced to 40 to 50 percent. The reduction in the amount of slash by harvesting to a three inch top and the use of slash reduction machines reduces soil disturbance. Dozer piling of slash can also be done lightly enough to cause less soil disturbance. Old habits are hard to break, however, and cat skinners still tend to do too much, close supervision is required.

Policies and guidelines have been developed to prevent construction of roads in or near streams. Buffer strips are established along streams in timber sale areas and along roads. Distribution of fine materials is the greatest concern in regard to trout habitat. Most of this silt comes from poor road location or placement of culverts. Ph ratios are considered to be acceptable at the present time.

Some drainages that have been heavily cut or burned, need to be left undisturbed for a period of years to allow revegetation. For example, specialists felt that any further cutting at present in Hay Creek on the North Fork would destroy the Cutthroat Trout habitat.

There was a great deal of talk about the importance of water in the management of the Flathead Forest and especially the significance of water quality as a measure of forest management quality. There was universal acceptance of that fact by all the staff as well as the specialists. The native Cutthroat Trout was also regularly mentioned as the best measure of water quality. Beyond that there was a lack of quantified data to identify goals or criteria for the measurement of water quality.

Some of the specialists were concerned about the lack of regional or Washington guidelines on water quality. A group of hydrologists put together such a statement and it is now under consideration in the Regional Office. (see appendix) They expressed a considerable need for hydrologic data which is not now available. The data needs expressed in hydrology were reiterated in virtually every field: soils, silviculture, wildlife and fisheries, geology, etc.

To make their analyses and recommendations, the specialists now depend on observation which in turn is based on their academic training and more recent experience. They recognize that these are educated guesses, often approximations. They would like to start developing data beyond the experience they may be accumulating. They can draw on Forest Service Experiment Station data, but too often these have to be extrapolated and interpreted for conditions on the Flathead and too often such data do not apply. Nevertheless, an important part of the specialist's job is to accummulate benchmark data on the Flathead by monitoring programs that test cause and effect relationships from on-going activities, but little time is available for this activity. The recommendation for monitoring arose both from specialists and from field managers but has not yet been put into practice.

Lack of inventory data was recognized as a general weakness. There is no inventory of soils except for a few local areas. There is a geology map available but it is not reliable in particular areas. As a consequence, areas of possible mass failure cannot always be predicted. The cause and effect relationships on fish and wildlife are recognized as weak. Growth and volume estimates for timber are unreliable. A complete inventory of the total forest resource is a massive job but must be undertaken soon if long range planning is to have a sound basis.

The development of knowledge for predictability in all resource fields will be an expensive and long time operation, but it is basic to sound management. There are ways in which this information can be drawn together into useable ways in the short run as a starting point.

Specialist's Needs

The specialists and field personnel recommended an increase in the number of specialists. They agreed that there should be specialists gathering scientific data now; others should be translating it for management and others working on the long range plan. At least a doubling of specialists' staff is needed to place the forest on a sound scientific management basis.

Specialists should also be developing training programs for the field people in each of the resource areas. Specialists should also have more opportunity to meet with each other, to attend special programs to keep current in their fields and to attend regional and national professional meetings in their areas to meet and exchange ideas with their colleagues.

The region should also make arrangements to use analytical laboratories in soils, hydrology, etc. They could establish their own lab facilities, or develop cooperation with such laboratories in other State and Federal agencies, universities or private organizations.

There also needs to be developed a system of follow-up so that the specialists have the opportunity to review the work that has been done not only to see whether or not their recommendations have been followed but also to give them every opportunity to learn from their experiences. This experience should help improve their capability and increase their usefulness to the agency.

An underlying concern of all the specialists we met with was career development. They were interested in their work but they all considered their job at a dead end. There seemed to be no career ladder evident to them. In most cases the job they have appears to be as far as they can go in the Forest Service. There are exceptions, of course, but most of them thought that their future lay in eventually moving to another agency. This situation might be alleviated with the employment of more specialists and developing several levels in each field. There may also be opportunities by moving into administration or broader specialist area. But so far these seem to be limited. This is not yet a serious problem on the Flathead: the men seemed to be happy and excited about what they were doing. But they have it in mind and it is sure to become progressively of greater concern to them.

F. A Case Study - Lower Sullivan Creek Sale

In order to illustrate how the specialists work on going projects a case study was made of the Lower Sullivan Creek Sale.

In this case study examination was made as to how the project was carried out, how the specialists worked and to what extent their recommendations were used and what effect they had on planning and practice. Some questions of procedure were also examined.

The Lower Sullivan Creek Sale on the Spotted Bear Ranger District, was finalized in July 1973. Because of the emphasis on minimizing aesthetic degradation and unfavorable impacts on a stream recognized as important to the local fishery, the sale provides an interesting case study. Additionally, the general area is recognized as a winter range for wildlife, and some of the sale's units are virtually contiguous with the Hungry Horse Reservoir (units 2 and 3) or a major access route (Road 895) to the Bob Marshall Wilderness (units 5, 6 and 7). Because of the area's cited high timber producing potential, its importance as a watershed, its value for wildlife and, at least indirectly, its use by recreationists, the Lower Sullivan Creek Sale represents a recent Flathead management decision made on a system possessing true multiple-use characteristics.

The following description of the documents reviewed in the Lower Sullivan Creek case is presented for several purposes. First, the documents clearly indicate the commitment of present forest personnel to environmental protection. Second, they also suggest some important data which are unavailable to specialists at this time. Finally, the documents provide insight into the use of environmental analysis in determining forest management activities and lead to several conclusions drawn on policy and enforcement at the Forest level.

An environmental statement was completed in January 1972 and included statements on hydrology, timber, recreation, transportation, wildlife and fisheries. The statement clearly identifies the Lower Sullivan Creek area as one with value for several resources and also as hydrologically sensitive based on the drainages' past fire and logging history, "numerous wet areas" and noted erosion problems on some roads in the vicinity. Three creeks, Sullivan, Quintonkon and Clark, were cited as excellent spawning streams, "primarily for west slope Cutthroat trout, an endangered species." These spawning grounds were suggested as having very high economic value based on studies conducted elsewhere.

The hydrologic report for the major Sullivan drainage basin stated that channel conditions were not good. The reasons suggested to explain these poor conditions were (1) wildfires which burned more than 57 percent of the watershed in 1919 and more than 25 percent in 1929; (2) more recent logging activities; and (3) the flood of 1964. Using regional guidelines, the hydrologist estimated percentage changes of mean annual run-off, peak flow and maximum channel impact period of several drainages in the sale area compared to those expected under fully forested conditions. Without further management activity, estimates for each parameter were above those expected from forested watersheds (Table 1).

Table 1: Estimated changes for three hydrologic parameters in Sullivan Creek drainage compared to the same drainage if it were fully forested. Data abstracted from Flathead Forest Environmental Statement for Lower Sullivan Creek Sale.

Watershed Unit	Mean Annual Runoff (%)	Peak Flow (%)	Maximum Channel Impact Period (%)
Sullivan	+ 8	+ 12	+ 26
Quintonkon	+ 8	+ 11	+ 20
Total	+ 7	+ 10	+ 25
Maximum allowable change for streams in poor condition from regional guidelines	+ 6-10	+ 15-20	+ 20

The estimated values for the two drainages contracted for logging exceeded the regionally suggested maximum for maximum channel impact period and were clearly approaching the maximum for mean annual flow.

At least partially based on the hydrologic condition of the area, the Lower Sullivan Creek sale seems clearly designed to minimize impact both on aesthetics and a stream recognized as one of the most important spawning streams for the Hungry Horse Reservoir. On paper, much care was taken to prevent deterioration of the Sullivan and Quintonkon Creek spawning grounds. According to the contract, timber is to be logged only between January 1 and March 15 of the five year period of the contract, tractor skidding is not permitted in the bottom of draws or live streams, skid roads crossing streams will be minimized, there will be no tractor logging on slopes exceeding 35 percent, and numerous special treatment areas were established along stream channels. In any special treatment areas, cable skidding or winching will be used and trees will be felled in such a way that they require little movement before extraction from the forest. Of the 766 acres which are to be cut, 122 are special treatment areas because of streams or reservoirs; 128 are special because of roadside; and 12 because of being in natural meadows, for a total of 262 special treatment acres.

The major concern hydrologically, while not stated, appears to be minimization of sediments generated by logging. Using a major control method recommended in a recent EPA Study (Midwest Research Institute, 1973), harvesting and reforestation systems were selected which would minimize soil disturbance. Selection cutting of individually marked trees was designated for all but a few acres of overstory removal. Selection cutting can be expected to increase streamflow less than clearcutting, and natural regeneration should be established with minimal site preparation, although some scarification was recommended to favor western larch establishment. The winter logging should decrease soil disturbance considerably, assuming an established snow pack during that period. Road construction was also minimized and most new roads are scheduled for closing at the conclusion of the sale. Streamside vegetation left in place will hopefully prevent undesirable thermal pollution of the stream, a phenonmenon which is reported to occur on the Forest when buffer strips are not left (Casey, 1971).

In general, the environmental statement and the sale contract indicate the Forest's awareness of both (1) the value of Sullivan Creek as a watershed and (2) reasonable management procedures which would minimize stream damage given the commitment to log. Theoretically, the sale is designed to minimally disrupt the ecosystem relative to almost all alternative harvesting procedures except prohibitively expensive one. The statement seems to meet many rules and regulations concerning the content of environmental statements (Federal Register, 1973).

When the environmental statement and contract for the sale are considered specifically, some difficulties in protecting Lower Sullivan Creek become manifest. Certain restraints in the contract are vague, and are worded in a way that prohibits evaluation of their probable effectiveness. For example, "In event debris...enters stream courses in amounts which may adversely affect the natural flow of the stream, water quality or fishery resources, purchaser shall remove such debris as soon as practicable..." (Contract, page 36). What amounts to an "adverse affect on water quality?" Will there be adequate supervision of this issue when interviews have indicated that sale administrators are overworked? In fact, discussions with a Forest specialist suggested that a road had already been constructed closer to the stream than permitted by the contract. The specialist attributed this to inadequate Forest supervision of the sale. Although the plans for the sale included preliminary discussion of environmental impacts and issues with logging personnel, it is difficult to assume restrictions like the debris statement will be met with no quantitative guidelines or, for that matter, data upon which to develop this quantitative information. However, there is some explicitness in the contract that was not contained in the environmental statement. For example, skid roads are not allowed within 100 feet of live streams and no skid roads are allowed in live or intermittent streams.

The environmental statement contains some quantitative information which at least initially seems questionable based on interviews with the specialists. Although the following relate only indirectly to water quality, they are significant. (1) "Only trees that will not survive 5-10 years will be classified as high risk and marked for cutting." (Page 1) (2) "The entire sale will be partial cutting, with plans to remove 25 percent to 50 percent of the volume." (Page 1) (3) "Where studies have been made, spawning areas annually yield from 1,000 to 300,000 dollars per acre. Any and all amount of measures to protect this valuable resource is economically, aesthetically, and socially justifiable" (Page 3). If the Sullivan Creek area is a productive timber site, it is surprising that 25-50 percent of the volume will not live for another ten years, particularly since portions of the area were already salvaged following the bark beetle epidemic. Despite the fact that "many of these trees exhibit signs of being overmature, deformed or diseased" (Page 1). The dearth of published knowledge of mortality rates for the species involved would preclude such statements.

The actual volume to be removed was estimated at 25-50 percent of the total volume. Based on notes of inventory data in the sale file, the estimate must be for the entire sale area of 1,200-1,500 acres, not for the 766 acres of stands specifically outlined for cutting. Despite the fact that the area to be harvested is less than 2 percent of the stated area of the Sullivan Creek drainage (46,200 acres), the described hydrologic condition of Sullivan and Quintonkon Creeks and the propinquity of the sales to those creeks, indicate that hydrologic conditions following harvesting that small area should also have been estimated before the contract was let.

The high economic value for spawning gravel cited was extrapolated from another area. However, since quantitative values were used to partially indicate the value of the fisheries resource, it would have been useful if estimates of gravel area to be affected had been obtained. Based on interviews, the specialists usually do not have time to pursue investigations of individual projects as fully as they might wish. It is clear that the fisheries resource of Sullivan Creek is viewed as very important by Forest and Montana Fish and Game personnel, and that any increased channel damage or water quality reduction could probably damage that resource. There was no quantitative evidence that the amount of streamside vegetation to be left standing would be adequate to avoid thermal pollution or, if some pollution is allowed, how much would be acceptable. More specific study also should be cited concerning the locations of particularly critical spawning beds within the stream system and in relation to stands to be cut.

In summary, a hydrologic analysis of Sullivan Creek indicated, based on two major fires, past logging and a flood, that there probably should be minimal disturbance[1] to this watershed until it has recovered more fully. In response to this hydrologic problem and because of the Creek's importance as a spawning ground, the Environmental Statement and Contract indicate that care will be taken to reduce hydrologic disturbance. A major question remains: why should any timber be removed from this area if fisheries values are as high as some specialists claim they are and when the primary reason for removing timber was stated as an economic one? Four of the six paragraphs included in the environmental statement on favorable environmental effects are related to timber production. One of the remaining two notes the aesthetic value of western larch in the autumn, and the final paragraph speculates concerning possibly positive wildlife benefits. No adverse environmental effects are specifically stated beyond the fact that slash will accumulate, there will be some aesthetic impact in travel zones, and the thermal pollution might arise if streamside vegetation is not carefully marked. Quantitative information is not presented for any of these issues. No baseline data are given on water quality or predicted changes resulting from the proposed management activities. Furthermore, no consideration is given to possible changes of dissolved chemicals in the stream water.

Although the Lower Sullivan Creek information indicates increased sensitivity toward water quality than the earlier case studies, it seems inadequate for wise decision-making among alternatives. Despite the importance of Sullivan Creek and its apparently degraded condition and the verbal statements by the Flathead Forest leaders that water was currently the Forest's most important resource, no discussion was made of restoring the watershed. Also, data used in the statement was either estimated, or extrapolated from uncited studies in other areas. The environmental analysis could be viewed more as a justification for the sale than as a truly viable tool for use in the decision-making process.

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[1] On reviewing the draft of this report, one specialist noted that he felt Lower Sullivan Creek could undergo even further harvesting without hydrologic damage.

Besides the paucity of various kinds of data, a final and major weakness observed in the Lower Sullivan Creek case is the timing of the specialists' input to the decision-making process. The specialists usually analyze a given sale after it has been essentially laid out by the district staff. Then, recognizing the position the district people are in, the specialists appear to shape their recommendations to best meet the sale goals within the constraints of the landscape. That is, environmental constraints and resources other than timber may not be adequately considered when the initial sale is laid out. An extremely important change is that the Flathead has begun to send the experts in prior to the district people setting up the sales. Only a general area for a possible sale is selected, and then the specialists are asked to come in and analyze the site. The specialists clearly favor the pre-sale observation much more than the de facto post-sale operation. To one specialist's knowledge, a review undertaken in the spring of 1973 was the first time this new procedure was used. It is essential that this new process become policy and it seems likely it will on the Flathead, if adequate funding is available.

G. Budgets and Budget Preparation

The Forest "management team" consisting of the supervisor, his top staff, and the district rangers, establishes each year the "program priorities." This was their listing for fiscal year 1973:

Program Priorities

1. Protection of existing resource values
   - Fire control
   - Hazard reduction
   - Maintenance (Other)
   - Protection of other resources (range, special use, wildlife, soils, water)
   - Recreation administration
   - Roads and trails
   - Sales administration
2. Land use planning
3. Timber "sell" program
4. Timber stand improvement and reforestation

(This listing and the data to follow are drawn from a document entitled: "Flathead National Forest Program of Work 1973 F.Y.")

This represents a kind of "prevent defense" strategy in a budget climate of extreme austerity. The Flathead people wanted first to protect the resource values charged to their responsibility, and only much later would they be concerned with improving them (through "timber stand improvement," for example) or incurring additional administrative obligations by selling more timber. In dollar terms, its meager funding for the "timber 'sell' program" or "timber stand improvement and reforestation," and relatively healthy funding for such items as "maintenance (other)," "protection of other resources," and "recreation administration" would be expected. This listing was in accord with the typical Flathead attitude of independent, localized decisions based on localized productivity; in short if expresses the "policy-of-intentions."

When the budget allocations were finalized, however, the "policy-of-fact" emerged.

If the program priorities 1 through 10 are ranked as listed, and the budget allocations 1 through 10 are ranked in descending order, it is found that the "policy-of-intention" has been nearly inverted:

Category	Program Priorities Ranking (Policy of Intent)	Budget Allocations Ranking (Policy of Fact)	Budget ($ Thousand)
Roads and Trails	6	1	1,551.6
Timber stand improvement, Reforestation	10	2	938.0
Hazard Reduction	2	3	400.0
Timber "sell" Program	9	4	372.3
Sales administration	7	5	350.9
Fire Control	1	6	231.0
Subtotal			3,843.8
Maintenance (Other)	3	7	212.0
Recreation administration	5	8	140.2
Protection of other resources	4	9	98.2
Land Use Planning	8	10	90.2
Subtotal			540.6
Grand Total			4,384.4

Given there is room here for varying definitions, by this analysis timber and timber-related activities on the Flathead account for 87.8% of its budget; all other activities account for 12.2%. If policy is what administrators do, the primacy of timber is not only conspicuous, it is overwhelming; and the "Policy-of-intentions," becomes, by comparison almost a contradiction.

The budget is the determinant in "policy-of-fact." The budget which the Flathead Forest receives is now strongly biased against the accomplishment of a sound environmental program. The Flathead staff is being constantly constrained by the limitations of their budget. A balanced program of resource management that can include goals of environmental programs will not be possible until the needs and support for such a program are expressly budgeted.

H. Enforcement

Accountability by the Flathead staff is the first step toward improving enforcement and developing an attitude toward living within contract specifications. The older functional organization made accountability more difficult. The timber staff might accede to demands or accept layouts violating the contract without the agreement of the line officers. The district ranger is now responsible for all decisions and activities on his district. In the new program approach the decisions are not made on a functional basis but in terms of program. The supervisor has taken some strong actions where contracts were violated. While accountability is a basic first step, there remains considerably more to be done before enforcement can really be considered an accomplished fact.

The contractors and operators on road construction and timber sales have by habit done only the minimum. Contract violations were common and patterns developed. Precedent for shutting down a contract for noncompliance has recently been established in the case of truck overloads. Suspension of contract still remains to be tested for other violations including those regarding environmental protection.

Under the policy of operator construction of roads the problem of enforcement is very difficult, almost insuperable. In most cases the man who has purchased the contract will subcontract road construction. Usually he shaves the price as much as possible, particularly when he has had to bid high for the sale. Consequently the road subcontractor cuts corners and barely meets standards, but the cost of road construction is low. A margin for profit and risk goes into the timber sale appraisal but this margin is often dealt out in the subcontract.

Some timber sale purchasers expect to make money on the road. A few efficient purchasers who have their own road building machinery expect to make a good share of their profit out of the sale from their ability to build the roads cheaply. Some purchasers bid in the sale, construct the roads and then sell the timber to someone else. In this case the subcontractor for the timber may not meet the standards on the timber harvest in an attempt to increase profits.

This arrangement leads to one of the major sources of environmental degradation. It requires very close supervision, virtually one Forest Service employee to watch each tractor. The threat of cancellation of the sale seems to be the only effective recourse and this has been accomplished only recently with the agreement of the Regional Forester.

The contract cancellation was on the basis of repeated violation of load limits on Forest Service roads. This has only an incidental relationship with environmental damage. However, the Forest Supervisor feels now that his authority to cancel contracts for violation has been established, he has the authority to cancel contracts on the basis of violation of environmental stipulations. This authority has yet to be asserted.

The right to cancel contracts for violation has been included as a contract clause for a number of years but until recently, it was never enforced. A new amendment to the regulation on cancellation of contracts became effective on September 10, 1973. An account of the new amendments was published in the National Forest Products Association's "Government and Forestry Affairs Report" recently:

Regulation on Cancellation of Contracts

> A new amendment to the Agriculture Department Regulation on Cancellation of Contracts became effective September 10, 1973. Two new cancellation provisions give the Chief of the Forest Service the authority to cancel timber sale contracts (a) for purchaser violation of Federal, state or local environmental quality standards, and (b) for cases where sale operations "would result in serious environmental degradation or resource damage."
>
> The Regulation amendment proposal to Section 221.17 of 36 CFR was first published in the Federal Register on April 23, 1973 and provided for a 60-day period for public comment. Industry written comments objecting to the provisions for the proposed amendment and suggesting needed revisions to the proposal were submitted during that period to the Forest Service for consideration.
>
> NFPA's Federal Timber Purchasers Committee reviewed a draft of the proposed amendment as early as May, 1972 and further discussed the two new provisions with the Forest Service at the May 17, 1973 meeting in Washington, D. C. Several of the industry-suggested changes were incorporated, but industry's objections against the need for the two new provisions were of no avail.
>
> The following three provisions had been in effect and are still unchanged:
>
> > Timber sale contracts and permits may be canceled:
> > (1) For serious or continued violation of their terms.
> > (2) Upon application, or with the consent of, the purchaser, when such action is of advantage to the United States or not prejudicial to its interests.
> > (3) Upon application of the purchaser if the value of the timber remaining to be cut is diminished materially because of catastrophic damage caused by forces beyond the control of the purchaser resulting in (i) physical change

> in the sale area or access to it, or (ii) damage to timber remaining to be cut.

The following two provisions are the new additions:

> (4) For conviction of violation of criminal statutes or for violation of civil standards, orders permits, or other regulations for the protection of environmental quality issued by a Federal agency, state agency, or political subdivision thereof, in the conduct of operations thereunder, on National Forest land, unless compliance with such laws or regulations would preclude performance of other contractual requirements.
>
> (5) Upon determiniation by the Chief, Forest Service, that operations, thereunder would result in serious environmental degradation or resource damage.

The two new provisions are aimed directly at strict observance of provisions for environmental protection. Provision number (4) is of special significance since it forces compliance of the operator to the "civil standards, orders, permits, or other regulations for the protection of environmental quality issued by a Federal agency, State agency, or political subdivision thereof." This clause places new responsibilities on the operator as well as the Forest Service to comply to the new Federal, State and local laws and regulations which have resulted from NEPA and the air and water pollution control laws. This emphasizes the stipulations in these acts that all Federal agencies are subject to them and are expected to take leadership in carrying them out.

The Forest Service has assumed the responsibility for enforcement of contract provisions on its own lands. It has developed cooperative arrangements with State and local law enforcement programs. In other cases it has called for support from Federal enforcement agents. The new environmental laws require new cooperative arrangements and new definition of responsibility in law enforcement. The limits of discretionary interpretation of the enforcement of laws have been considerably reduced. To the extent that contract provisions are based in environmental law, their enforcement may no longer be the sole responsibility of the Forest Service. It may have to share responsibility or be subject to review by State and local officials as well as subject to citizen suit.

The Flathead staff did not believe that they had authority to debar anyone from bidding on future sales, but a recent new regulation does permit the Forest Service to do so, and the grounds include protection of soil and water resources. The following excerpt from the NFPA's "Government and Forest Affairs Report" July 15, 1973 mentions the new regulation and describes the industry's reaction to it:

Regulation on Debarment of Bidders

> On May 15, 1973, an Agriculture Department Regulation amendment on Debarment and Suspension of Bidders was put into effect. The new Regulation, Section 221.10a of 36 CFR, outlines six specific areas where timber sale contract violations are regarded by the Forest Service as so serious as to justify debarment or suspension . The Forest Service had general department authority in the past, never for specific contract violations.
>
> The proposals on debarment of bidders were initially given to the industry in March, 1972. They were thoroughly reviewed by the industry and discussed as several Forest Service-Industry meetings the past year. The proposed amendment was published in the Federal Register last February and was subject to public comment for a 60-day period. Industry comments and objections to the proposed amendment were sent to the Forest Service for consideration. None of the industry suggested changes, however, were incorporated in the final version of the May 15 Regulation amendment.
>
> Violations of the following timber sale contract provisions by the purchaser are regarded by the Forest Service to be so serious as to justify debarment or suspension of bidders:
>
> (a) Fire suppression or prevention and the dispoal of slash;
> (b) Protection of soil, water and residual trees when such failure causes significant environmental or resource damage;

(c) Removal of designated timber when such failure causes substantial product deterioration or conditions favorable to insect epidemics;

(d) Restrictions on the exportation of timber included under the contract;

(e) Access by the Forest Service upon its request to purchaser's books and accounts; and

(f) Processing by small business on set-aside timber sales.

In summary, the Flathead supervisor and staff consider that the system of contracting and sub-contracting for road construction and timber harvest is the cause of the most serious enforcement problems on the Flathead National Forest. Since these activities are also the principal sources of air and water pollution, enforcement becomes a crucial issue in pollution prevention and control. Because of weak enforcement in the past, operators tend to do only the minimum required and to do even this has required close supervision, which has not always been possible. Placing accountability on the ranger has given focus to enforcement.

The authority to close down sales has been recently excercised on the Flathead. The further authority to exclude chronic violators from bidding on Forest Service contracts further strengthens enforcement authority.

A General Statement with Regard to Roads

The engineering specifications with regard to road construction are very complete. However, road planning, reconnaissance, design, and subsequent maintenance are equally as important as the specifics of construction. The Environmental Statement--"Three year Road Construction Program for Flathead National Forest" conveys very little in the say of specifics.

Here are some examples:

"Water: the quality of water will remain high. Planning, construction, and maintenance of roads will be controlled to reflect water quality considerations. Every effort will be used to insure water quality continues to meet or exceed current state and Federal standards."

Another quote, "Engineering standards such as width of road, grades, and surfacing material, are continually being examined and brought into accord with land-use planning decisions."

Road planning represents a thorough analysis of need as well as complete examination or route alternatives. The most experienced and competent talent is a necessary and first step toward location. The design should provide for a safe, utilitarian facility, but it should be recognized that, with few exceptions, forest roads are not high-speed roads. Road width is frequently held up as an example of "overbuilding" when in fact it is only one factor in the total sphere of topographic or landscape modification. Road width increases exponentially as the steepness of the topography increases. Further, environmental impact increases as horizontal and vertical alignment standards are increased. The expression that roads should "lay easy on the land" is of particular importance in the development of forest roads.

The importance of adequate road maintenance is a factor that receives minimal consideration in the Forest Service road construction activities. The mileage of constructed roads far outstrips the money available for adequate road maintenace. The agency commits the lion's share of its appropriated funds to construction of new roads at the expense of providing maintenance. (Refer p. 132).

The Forest Service believes that most of the problems caused by roads can be eliminated if the road is carefully laid out, carefully constructed, has proper drainage and maintenance. But only in a few cases has this happened. The best example on the Flathead appears to be the Griffin Creek road. There will very likely always be some run-off and erosion from even the best designed and constructed road during construction and for a few years or so after completion.

One of the problems that concerned the Flathead staff was that roads tended to be over-built and perhaps over designed. As one ranger put it, there was too much engineering input and not enough environmental input. Awareness of this problem is a start. Part of the problem apparently lies with the construction machinery available. It is hard to build a 12 or 14 foot road with a 16 foot blade. In the past concern was with meeting minimum width and so the pressure was toward over construction. Long tangents were favored over design with the land. Roads can be built with far less earth moving and disturbance than has been the practice. Again, close supervision will be necessary.

Road closure is now required and enforced for most of the skid roads or lesser roads. "Putting to bed" by seeding and cross drainage reduces sources of possible continued erosion. Part of the concept for road construction seems to be a belief that future harvest technology will require the roads. The system built ten to fifteen years ago already demonstrate that this is hardly valid.

The fact that earlier harvest has been on the best sites means that future timber harvest will need to go to progressively poorer sites where conditions tend to be more fragile and where more acres will have to be harvested to get a given amount of timber. The environmental hazards are going to increase under these conditions. The requirements for supervision can only increase unless some conditions change. One ranger stated that he had made a point of getting together with the operators, equipment drivers and others to explain the problem of environmental protection and inviting their help in meeting standards. He reported encouraging success with this approach. He said that they not only did more careful work themselves but pointed it out to others. He admitted limitations in that some people tended to be uncooperative or not willing to go to added expense because of the subcontract under which they worked.

There are two possible actions which might be helpful here. One would be to let separate bids for the road construction and for the timber harvesting. The other would be for the Forest Service to build the roads itself. Both of these ideas have been under discussion for some time. The first would largely avoid the subcontract which causes a man to cut corners. It might also make it easier to revise contracts when the need arose. Because environmental measures are new and planned practices may not always be sufficient, the ranger needs the power to require extra or revised provisions when he sees the need.

Road construction by government has been proposed many times. It would very likely be more costly but it would make supervision and enforcement far easier. One problem that has also been foreseen might be a tendency for the Forest Service to overbuild or to build roads into more areas before they were needed or before the situation had been thoroughly considered. If mistakes occurred, there would be no question of accountability.

There are some side benefits from government construction. Contractors now have to bear the cost of road construction which might be considerable. Very often they have all available credit tied up in road equipment and construction. This tie-up of capital may reduce the industry's potential for investment in mills which could improve utilization of raw material or the development of new products.

Government construction of roads could also increase competition in bidding on timber sales. A major road now requires a large sale which eliminates all but the largest mills. The opportunity to make smaller sales or sales of more variety in size might also make it more possible to avoid environmental damage by permitting better design with the land.

I. Regional Inspection Report of the Flathead NF

The regional inspection report of August 6-10, 1972 has been referred to several times throughout our report. It is appropriate because of its timing and because it dealt directly with the water and air quality effects of forest activities on the Flathead National Forest. Prepared by Carl W. Wetterstrom and James E. Eggleston of the Missoula regional office, it is labeled: "Technical and Managerial Inspection-Soil, Air, and Water Management, and Water Resources Related Development Activities, Flathead National Forest."

This report has been referred to and quoted from earlier mainly to provide documentation of the recognition by the Forest Service of past environmental degradation resulting from earlier forest management activities on the Flathead National Forest and also recognition that major steps have been taken to change these earlier practices.

Included from this report are the recommendations by the review team which refer to additional improvements needed to further advance programs for protection of water and air quality. The report recognizes that the steps taken so far, while greatly advancing measures for the protection of water and air quality, are not yet sufficient.

The report is interesting as a measure of the level of protection which the Forest Service considered necessary in 1972. The hydromet system, additional specialists, continuing education for the specialists, watershed-by-watershed use of their vegetation manipulation procedure to calculate allowable clearcut condition, stringent supervision, etc. are all calculated to provide more understanding and control. There is agreement with the merits of each. The questions which need to be raised are largely of degree.

The report does not base its recommendations on any specific criteria except general criteria of improvement or adequacy "to meet future needs for quality management," or "to prevent unnecessary soil and water damage."

The report makes no mention of the criteria laid down in the Water Pollution Control Amendments Act of 1972. It may not have been available and the Forest Service had not yet established its own operating procedures under the Act. The recommendations in this report were considered as well as other operating procedures, plans, and proposals in order to identify and assess the present awareness and activity regarding water and air pollution control. (Inspection recommendations follow)

Recommendations and Discussion
(emphasis added in all cases)

1. The Forest consider the hiring of another team consisting of a soil scientist and hydrologist to work primarily on project (or long-range planning) work.

2. The Forest plan, establish, and operate a Forest-wide hydromet network, *including* water quality monitoring, adequate to meet future needs of *quality* management.

3. The Forest consider the hiring of a technician primarily to operate the hydromet network and process the data. This technician position should be multiresource financed and can do other priority jobs.

The Region's soil and water program is directed toward involvement in long-range planning, short-range planning, project planning, and for hydrologists, establishment and operation of a Forest-wide hydrometeorological network. The soil scientist and the hydrologist on the Flathead Forest are deeply involved in the long-range planning effort, spending about 75 to 80 percent of their time in this type of work. This is the approximate amount of time that the Regional Office has suggested for Forest-based soil scientists and hydrologists to spend on this activity.

The soil scientist and hydrologist are working well together as a team in their own right, and they have also been assigned leadership on the Forest long-range planning team. The team's work being accomplished in planning as well as on projects, seems to be very well accepted by the Supervisor, Staff, and Ranger District personnel. (See attached 6520 memo of February 8, 1972, in appendix, page 20.)

This leaves about 20 to 25 percent of their time for short-range planning and project work, with the hydrologist also responsible for setting up the hydromet network. On the Flathead Forest, however, short-range planning and project work is of such magnitude and of such volume, that the specialists cannot do justice to this type of work as well as maintain their necessary leadership in long-range planning. As a result, *specialist input to project work is limited, and practices that degrade quality are occurring at a rate which is not considered acceptable*. One example of this is the Puzzle Creek sale which the Forest is now trying to modify extensively or to close out completely. The soil scientist and hydrologist did not visit the sale area until after the sale was made. *Soil and water problem impacts of an irreversible nature have been encountered*. *Quality has been impaired and rehabilitation is needed*. Many of the problem areas could have been eliminated had the specialists had time to participate at the project level.

Likewise, the hydrologist does not have time to adequately maintain the meager hydromet and water quality network that has been established on the Forest. The Flathead Forest, approximately 2,350,000 acres, has only three operating stream gages and seven water quality stations. The stream gages are all on tributaries to South Fork Flathead River above Hungry Horse Dam while the water quality stations are all on the Flathead River (North Fork) which is being studied as a Wild River. Of a potential 90 months of station records, only 19.5 months (20 percent) of record are available for analysis, and this is very discontinuous. (See 2530 memo of September 6, 1972, in appendix.)

The above facts indicate three areas of concern. These are: (1) the soil scientist and hydrologist do not have time to properly investigate all projects--planned or operating, (2) the Forest essentially has no hydromet system, and (3) the instruments that are installed are not being operated adequately. We strongly believe that the Forest should improve their performance in these areas of consideration. We do agree with the Forest in their basic philosophy concerning the hydromet network. That is, if you can't do it right--don't do it at all. We believe that it should be done, however, and done right.

7. It is recommended that allocation of WRDRA funds be continued to the Flathead Forest in connection with the Hungry Horse project.

The Forest, in a summary writeup plan dated March 25, 1971, analyzed the water values of the South Fork drainage basin above Hungry Horse Reservoir. This writeup gave a summary of the inventory data available and the inventory data needed to complete a soil-hydrologic resource reconnaissance and the need to write a watershed treatment prescription using WRDRA funds. The soil-hydrologic resource reconnaissance was to begin in F. Y. 1972 and to be completed in F. Y. 1975 with the watershed prescription to be written for the 400,000 acres of the South Fork drainage basin above the Hungry Horse Reservoir and outside the Bob Marshall Wilderness area. The South Fork drainage Basin above Hungry Horse was divided into three working areas for the purpose of completing the soil-hydrologic reconnaissance work. The reconnaissance work was to be implemented with water quality sampling including bottom sampling of the Hungry Horse Reservoir.

The Forest has completed the fieldwork for a soil-hydrologic reconnaissance in the Spotted Bear River drainage (unit) in connection with multiple land-use planning. Planning for a portion of the 1972 summer season continued on a high priority land unit below Hungry Horse Reservoir. Because of changes in priorities in relation to multiple use planning, the Forest is currently not on schedule as to the March 25, 1971, plan and commitment. However, recent changes in multiple use planning because of Forest financing problems and the BPA change in plans in connection with the Libby-Conkelley transmission line, the Forest is again accomplishing soil-hydrologic reconnaissance work in the South Fork drainage basin above Hungry Horse Reservoir.

8. The Flathead should give consideration to intensified use of remote sensing techniques.

Remote sensing on the Flathead Forest has not been extensively utilized to date. To our knowledge, the only current work has been some comparisons between infrared and black and white photographs. Remote sensing can include sensing for water quality, but it is not limited to that use. Landscape mapping can be improved, and perhaps speeded up, with color and/or infrared aerial photos.

9. The Forest continues to establish firm controls over project work in order to achieve quality, balanced soil and water management. (Special emphasis on road location, construction, road maintenance, and logging operations.)

The overall Forest planning program objectives based on field-office evidence and discussion strongly indicate that the long-range planning in relation to soil and water management appear to be good. This we believe is particularly true in connection with endeavors to correct low-quality management. There are indications that phase II of the multiple use planning will determine the mix of soils and water as to priority and value. The planning emphasis as to soil and water values on the Flathead Forest is currently strong and balanced. In the next 2 or 3 years, the balanced emphasis being placed on soil and water management planning will have to reflect a balanced and unusually strong effort in the necessary implementation in project work--timber sales, road construction, etc. Implementation to enhance the predetermined mix of soil and water to enhance their values as well as other values will be difficult because of past traditions and practices.

10. The Division of Soil, Air, and Water Management work out the necessary details and arrangements to assure the opportunity for the soil scientists and hydrologists to formally or informally meet with professional teachers and professors and discuss related academic disciplines.

11. The soil scientist and hydrologist consider formal refresher academic short courses in the appropriate fields of their professions every 3 to 5 years.

The Forest Supervisor and planning staff of the Flathead Forest recognize the need for keeping their soil scientist and hydrologist (and other specialists) up to date concerning their respective professions. Technical training sessions, professional societies, symposiums, industrial seminars, and university programs are approved for attendance when justified. Special trips to research centers or universities to meet with selected individuals on selected problems are also approved on occasion. The soil scientist and hydrologist must stay professionally viable by searching for and developing new methods and techniques through attending professional society programs and other meetings.

Likewise, approval for purchase of technical reference books and periodicals is also approved, and the specialists are building a sound reference library. They have also volunteered to take the library of the Division of Soil, Air, and Water Management should that library be discontinued.

Concern was expressed for need of informal meetings and get-togethers with related academic disciplines, university professors, and professional teachers in the universities.

The Region 1 "Procedure to Evaluate the Hydrologic Effects of Vegetation Manipulation" is being used on the Flathead Forest. Since the hydrologist is involved in the long-range planning, District personnel are using the procedure in a gross manner as a warning system. When this analysis indicates a problem in overcutting may occur, the services of the hydrologist are requested on a project basis.

Intensive use of the procedure, on a drainage-by-drainage basis as in the North Fork Flathead River, presents a calculated "hydrologic recovery period." This, with other factors is used to determine how much of a drainage can be in a clearcut condition at one time without causing an increase in peak flow volumes sufficient to cause channel damage. When time permits, or need demands, an additional step can be taken. This permits determination of how many acres can be cut per year, without infringing on the "allowable clearcut condition" previously determined. A good estimate of the time required to convert the remaining old-growth stands to new, vigorous stands is provided. Available research data and correspondence with universities and research stations are used throughout the procedure. Required data are often of a limited nature, however.

The lack of intensively using the procedure throughout the Forest has recently been the cause for concern by the committee headed by Dr. Robert Dils. The general interpretation of the procedure, plus estimates, have been used to modify the conversion period of oldgrowth stands from 32 years to 50 years for the Resource Allocation Model (RAM) program operated by the Division of Timber Management. The 50-year period is used as an average conversion period for the entire Forest. The Dils Committee felt that the 50-year conversion period is not justified to protect watershed values alone in light of the additional mortality and loss of timber that would occur. They thought that if any other constraints exist on the conversion period, they should also be emphasized. These could include aesthetics, road development, wildlife, fisheries, etc.

Shortly after the Dils Committee visited the Flathead Forest, Region 1 representatives met with representatives from the Intermountain Station, Rocky Mountain Station, and Dr. Dils, to discuss the Region 1 procedure. It was the consensus of opinion that the procedure is technically sound when used on a intensive basis utilizing the best available information on water yield, water yield increases, channel condition, allowable in-channel increases, and hydrologic recovery period. The major point of discussion was that the 50-year conversion period was an estimated average for the entire Forest and that the procedure had not been worked out for each individual drainage.

12. The Forest utilizes the vegetation manipulation procedure on a watershed-by-watershed basis carrying the calculations to the point that allowable clearcut condition per year can be determined. These figures should be projected to better estimate the conversion period.

13. The Forest Supervisor continues to take direct aggressive action to assure that personnel who have the responsibility for planning, formulating, or executing possible irretrievable land management decisions know and understand the meaning and objective of the Forest coordinating requirements. This would include all personnel directly connected with field operations--the planner, administrative services, professionals, foresters, specialists, equipment operators, technicians, engineers, foremen, strawbosses, and "the man who hangs the red ribbons in the woods" to indicate a possible road location route.

14. Consider on-the-ground organized training or mutual discussion sessions to determine what is considered quality management on the Flathead Forest in connection with resource utilization and management area development, and the prevention of soil and water degradation.

15. Determine what can and should be done wherever possible to reduce unnecessary road widths and density, particularly in the high water-producing basins having sensitive and complex soil and water relationships.

16. Get compliance to prevent unnecessary soil and water damage in timber sale or burned areas cleanup operations through stringent supervision and general understanding of possible potential soil capability damage, accelerated erosion and water degradation.

17. Develop a sensitive awareness among all field personnel for the prevention of soil sediment being drained directly into stream channels from road drainage systems and from all other project development causing disturbance.

The Flathead has numerous examples and instances where past and some current road construction practices are allowing water-carrying sediment from road drainage systems to drain directly into streams (item 12). The Forest is in the process of correcting this practice in new construction projects as well as endeavoring to eliminate old problems. The Forest also has examples where the overbuilding of roads has added an additional impact on the water regime. The Forest is aware of this and is analyzing each case on projected future use and need information (item 14).

General Forest Zone - Items 5, 10, 11, 12, page 44 - Modification of timber harvesting in drainages involving unacceptable watershed degradation, either existing or anticipated, based on hydrologic analysis (items 11 and 12).

The Forest is moving rapidly in implementing items 11 and 12. Modification of current timber sale contracts, use of vegetation manipulation guides and stream channel classification guides, creation of marginal timber cutting areas to withhold development until either more hydrologic and soils information is available and/or a compatible system of logging can be utilized which will prevent watershed or drainage degradation.

Water Influence Zone - Item 1, page 46 - We observed instances of past practices which had violated the same coordinating requirements which are found in the initial Regional Multiple Use Guides. The Flathead is moving to implement this coordinating requirement as found in the current basic land management plan.

Basic Assumptions - Resources and Uses - item 13, page 35 - The Flathead has been in the process of modifying timber harvest programs and going timber sale contracts. This path is currently not an easy one. The Flathead will need administrative line support to maintain quality management.

General Comments

Several items pertaining to the functional aspects of the Division of Soil, Air, and Water Management were discussed and several sites were visited in the field. A general discussion of these items and sites follows, although no recommendations are made.

The whole cooperative snow survey effort with the Soil Conservation Service needs to be reviewed. The Forest (among others) would like to get out of the snow survey business, especially in wilderness areas. This item needs to be resolved before this snow survey season (1972-1973). The Division of Soil, Air, and Water Management is working on this problem and will have recommendations to the Regional Forester's staff by early winter.

The Annual Watershed Accomplishment Report (form 2500-4) is not doing the job it was designed for. This form calls for functional reporting when Forests are working on a multiple use basis. As a result, reported units are fictional and often deceitful. Basing requests for funds or accomplishment on these records is shaky, at best. Form and reporting units need to be revised. The Division of Soil, Air, and Water Management should work through the Washington Office and explain justification for change. The Flathead Forest has a deep concern for this problem and positive action should be taken to determine what can be done to change the report or reporting procedure.

The approach used by the soil scientist and hydrologist in giving information to the land manager is very good. This approach is suggesting what might happen if the project is consummated, and giving, if possible, alternatives which will have the least impact on the land. The land manager is given the choice of making the final decision, for which he is responsible.

The Forest has only one municipal watershed plan, as such. However, (the level 1 multiple use planning now in progress will serve as municipal watershed plans as long as the municipal watershed is recognized) in the planning process. Although municipal watershed plans per se have been de-emphasized in Region 1, a municipal plan of some sort, approved by the municipality, is required if management activities are taking place. The Forest has four municipal watersheds.

The Forest has not had a major watershed rehabilitation project, as such, in recent years. Those that have been accomplished have been in relation to fires and floods. The Forest does have a backlog of rehabilitation work that could (should) be accomplished if funds were available. Most of this work is erosion control on old timber sales and on abandoned roads and trails.

V. EVALUATION OF INFORMATION NEEDS FOR PREVENTION AND CONTROL OF NONPOINT POLLUTION

The study of the Flathead clearly revealed the need for greater knowledge before the objectives regarding nonpoint sources of pollution can be met. Some of the information required is specific to the Flathead National Forest, but many of these data may also be lacking on other Forests in Region I and, in fact, throughout the Rockies.

The absence of this type of information probably suggests that change is needed in national attitudes and policy concerning applied research. Related to this need for applied research and a responsive applied-research community is the need for mechanisms that more effectively transmit recent, relevant research findings to the land manager and the public. Conversely, there should be open communication to the research community from the manager and the public concerning research needs and desires.

Experience on the Flathead suggests that knowledge is needed at three levels: (1) baseline data on undisturbed ecosystems and additional research on ecosystem processes; (2) applied research that would lead to reasonable accuracy in predicting environmental changes resulting from management activities; and (3) research on communicating research results, or the actual education of management personnel at all levels in the Forest concerning existing knowledge in environmental areas, planning, and decision-making.

Baseline Data and Ecosystem Function

At the present time, most activities with the potential to degrade air or water quality on the Flathead National Forest are those associated with timber harvesting and road building or maintenance. There is no major threat of pollution arising from the use of pesticides or fertilizers (Seastedt and Tibbs, 1973), although this situation could change with the adoption of more intensive management. Of the remaining major pollutants arising from silvicultural practices (Midwest Reseach Institute, 1973), mineral soil, organic matter and thermal pollution all could create problems on the Flathead. Additionally, dissolved nutrients seem to be generally overlooked nationally as a potential source of pollution. Recent studies in New Hampshire suggest, particularly on shallow soils or soils with relatively low cation exchange capacity, that this oversight should not be accepted until it is proven that harvesting does not lead to significant changes in this important aspect of water quality (Likens et al., 1970; Pierce et al., 1973).

Specialists on the Flathead are particularly concerned with sediments, hydrologic budgets and forest management. Most agree that adequate baseline data on water flow, ground water, soils, and geology are lacking. Additionally, an inspection report from the Regional Office (August 6-10, 1972) stressed the need to establish or re-establish a complete hydrometeorological network on the Forest. The report also commended Forest specialists for not doing so half-heartedly, however, citing the need for greater financial support before the network could be properly located, maintained and utilized.

At this time, the Forest Service does not have adequate baseline information to determine quantitative changes in water quality or quantity that might result from any management practice. Furthermore, they probably do not have adequate standards for determining whether any change is or is not acceptable. For example, the 1971 edition of water resource data for Montana (U.S.F.S., 1972) cites only two stations in or very near the forest at which water quality monitoring was being done. Some base data are available from the Flathead River near Big Fork in Flathead County, and fairly extensive temperature data are available from the South Fork near the south end of Hungry Horse Reservoir. The more extensive data collection from Big Fork was discontinued in June, 1971, but does contain a fair amount of information on dissolved nutrients, humidity, temperature, etc. The drainage area monitored by this station covers 6,300 sq. miles. Some water quality data have been collected during the planning portion of Spotted Bear district, (U.S.F.S., 1973). These data, although on a much smaller drainage area, are minimal in that they were determined on one day and they do not include measures of sediment or specific chemicals. According to the Forest hydrologist, the Forest is cooperating with State agencies when possible to generate new information on baseline water quality on the Forest.

When determining what would be an acceptable change in any aspect of water quality, Forest personnel referred to current water condition criteria from the American Fisheries Society and State standards, which have been developed from various parts of the country. Since baseline data are largely lacking, and State standards have not been established for small streams, these are the only data they can rely on.

There is clearly a need to review any standards regularly, but it would seem nearly impossible to operate under present conditions. Water quality standards for various ordered drainages must be developed soon and must be developed with sensitivity to both biophysical and social portions of the forest ecosystem. Although an attitudinal rather than a research need, the Forest, and in fact the Region, should have a clear, well-defined statement of goals with respect to water resources and relate these goals to other responsibilities, particularly timber management. Apparently a draft document concerning Regional water policy is being considered, but is not now available. (see Appendix)

Because of the relationship between soils and sediments, several specific topics of concern were cited by the specialists. These included the need for (1) better surveys to identify areas of high potential mass failure hazard; (2) more information on mechanical properties of soils; (3) better understanding of ground water and its variation and importance in terms of stability on different slope conditions; and (4) information to verify a bedrock map (Johns, 1964) on potential management areas and to delimit and describe glacial deposits and lucustrine silts. At a later time, one specialist also foresees the need for soil fertility information.

An additional subject that is indirectly related to water quality and which clearly requires more basic information is allowable cut. Since this issue was considered in a separate section, it is adequate here to simply note that the forest specialists are unsure of the reliability of information on growth rates, mortality rates due to insects and disease, and regeneration rates. Knowledge of these three rates is basic to establishing timber management plans and is, therefore, important when analyzing the environmental impact of a management objective. Research should be conducted on each species, but in terms of water quality, the regeneration aspects of Engelmann spruce (*Picea engelmanni*) at high elevations and on steep slopes seem particularly important.

Another subject in need of research is economic analysis and its use in multiple resource management. Decision-making skills are available, although they are not used to maximum benefit on the Flathead. A basic problem which must be addressed when considering impact is that of integrating quantitative data, some of which are readily expressed in dollars, and qualitative data in the decision-making process. Better or more utilitarian techniques for arriving at decisions using both types of data would be a boon to the Flathead. Such procedures would be particularly valuable for areas currently viewed as marginal for timber production due to poor growth potential or environmental "sensitivity."

Environmental sensitivity itself must be defined and described in a defensible manner. Planning efforts which are not based on sound analysis of the land and ecosystem function are unlikely to accomplish their objectives. A Rocky Mountain regional survey (TIE, 1974) will determine the research base for a region-wide ecological zoning, which convincingly and accurately delimits areas by their sensitivity. Although the Flathead National Forest alone cannot be expected to accomplish the task of defining sensitivity, and although its recent efforts in this direction (U.S.F.S, 1972) are a good sign, it seems impossible to effectively plan and manage a multiple resource area until sound, scientifically valid procedures for zoning are developed.

Applied Research

The greatest need facing the Flathead personnel in terms of water and air pollution control is that of being able to predict the effects of road building, timber harvesting and silvicultural practices on the water and air regime. Other uses, including recreation and grazing, are significant as possible contributors in localized areas to water degradation, but their importance generally is overshadowed by timber management. The questions regarding timber are complicated by the impacts of fire, both wild and prescribed.

To understand the environmental impact of any timber management activity, the Forest staff must be able to predict the effects of planned manipulation of stream channels, water yield, and timing and duration of flow. Besides having inadequate baseline data and standards for water quality, forest personnel do not have the capability of predicting changes in water quality due to manipulation. Although Region I as a whole and the Flathead Forest in particular have made significant philosophical strides in terms of protecting water quality, their ability to predict quantitatively the effects of alternative procedures is almost nil. Their ability to predict changes in flow amounts is better, but much work has to be done to make this type of prediction specific to different areas of the forest.

The Forest specialists are aware of the potential dangers of extrapolating results from other regions to the northern Rockies. To make judgments internally and to portray accurately to the public what the results of alternative practices will be, forest managers must have more empirical data, and procedures should be developed to obtain them. Even changes in water quantity are difficult to predict on a variable area like the Flathead (Dils et al., 1972; Delk, personal communication).

Change in sediment load of streams is recognized as the most important negative effect of forest land management (Midwestern Research Institute, 1973). The importance of dissolved inorganic nutrients (U.S. Senate Hearings, 1972) and dissolved organic compounds (Midwest Reseach Institute) is not well understood or documented, particularly in the Rocky Mountain Region. With the common practice of burning as part of the silvicultural program in this area, it seems particularly important that these lesser understood pollutant pathways be researched. Changes in water temperature can be minimized with substantial buffer strips along the streams; but how narrow these strips can be and still produce their desired effect is unknown. Standards for stream temperature may be particularly difficult to evolve, since it is conceivable that raising stream temperatures in some mountain streams might be desirable in some cases (Dils et al., 1971).

There must be a massive coordinated effort to determine the environmentally safe limits of forest manipulation in the northern Rockies. This research effort would have to be directed specifically at gaining the capacity to predict changes in valuable resources due to land management practices in the forest. Because of the great variability of the region, this task seems overwhelming. However, teams of researchers could accomplish much by working on recently manipulated areas in the region and comparing these areas with similar undisturbed areas. A concentrated effort for a relatively few years should provide substantially better information than is presently available. The possibility of a region-wide effort to gain reasonable predictability should be seriously pursued.

More empirical research and additional synthesis on the impact of clearcutting on stream values could be done rather quickly in the major logging regions of the United States. It is clear, however, that a phase of that type of research would have to determine the effects of timber harvest on water (or air) at various distances from the actual cutting and at different times following harvest, concomitant with regeneration. Research of this nature has been called for by the Forest Service, Congress, and the National Academy of Science and others (e.g. U. S. Senate Hearings, 1971; N. A. S., letter of David Gates, 1972; The Institute of Ecology's report: Man in the Living Environment, 1971).

A major problem noted on the Forest is that the reliability of some predictive exercises is not known. Because of the dearth of quantitative information, any new data may sway decisions on a multiple-use area in a way that is not proportional to their accuracy or to the relative importance of the resource being described. Conversely, if these data seem contrary to existing plans, they may be discounted as weak. When meeting individually with members of a planning team, it was apparent that the specialists had different opinions on the predictive capabilities of any one discipline. The specialist in a discipline often had less confidence in his information than his fellow team members in other disciplines did. If a little quantitative data can become disproportionately powerful in decision-making, the historical emphasis on and the heavier staffing in timber and engineering (compared with landscape architecture, hydrology, soils, geology and wildlife) must be viewed cautiously by the Forest. Efforts to increase knowledge of water and other resources, besides being needed, should help to balance the consideration of different resources in decision making.

For example, the key area of specialization in nonpoint pollution problems is aquatic biology. While soil scientists, hydrologists, geologists and others all contribute significantly to identification and solution of problems, without considerable strength in aquatic or fisheries biology the team is not properly balanced.

Since there is a clear and urgent need for greater predictive ability on the Forest, the specialist should examine major projects after completion as well as before. This procedure would permit gathering specific empirical data on the Forest. At this time, specialists do not have the time to undertake such activities. Much can be gained by cooperative efforts with the USGS, SCS, Montana Departments of Fish and Game and Health, and universities.

However, fragmented efforts will not produce rapid, solid findings. If the need for baseline data, well-designed quality standards, and predictability is accepted, there must be research to determine these values by various groups. The research arm of the Forest Service does not supply the Flathead Forest with needed information on water quality. The administrative arm of the Forest Service does not appear adequately funded or able to undertake work on water quality with much rigor or depth.

The fact that some research has not been undertaken and that other research is minimally underway in the region suggests that the research community has not been promptly responsive to the demands of the NEPA. Certainly the situation is improving somewhat, but the rate at which it is improving is much too slow. The importance of NEPA to a forest such as the Flathead, where almost all high level forest personnel recognize water as the most important resource of that area, suggests that some sort of major coordinated effort to obtain needed water quality information must be undertaken.

Management Personnel and Research Findings

Available information and new data will not be effectively used unless they are known and accepted by Forest Service management personnel and timber purchasers. The Flathead is making efforts to inform its field people and the purchasers' crews of the reasons for environmental precautions. The Forest specialists serve as instructors of District personnel, as well as planners. However, ways of fostering more effective communications among researchers, specialists and field people should be determined.

A problem referred to frequently in our visits to the Forest was that of overdoing scarification. Three factors of particular importance in sediment control are the quantity and intensity of run-off, the susceptibility of ground cover and mineral soil to erosion, and the quantity and placement of certain types of forest debris (Midwest Research Institute, 1973). The awareness of the sale administrator and the heavy equipment operator to the latter two factors and skill to doing something about them is essential to minimize environmental disruption. Over-scarification is a prime example of creating conditions which will enhance the erosion potential of a harvested area.

Another important need at the ground level is more information on Environmental Impact Statements and more effort to select the best personnel for preparation of these statements. The Environmental Statement, if well done and if accepted as positive management concept, can be a very useful management tool. The approach used by some Forests in preparing statements is being investigated in a study funded by CEQ (R. Spray, Bitterroot National Forest, personal communication). Considerably more effort could be put into Environmental Statements than has been in the past. The personnel preparing them should be qualified and willing to undertake this time-consuming and important procedure.

Environmental Statements seemed to be considered, at least in some circumstances, a hurdle to management action rather than a tool. Research should be undertaken (1) to describe statement preparation in greater detail (i.e., Federal regulations must be more specifically interpolated), (2) to determine or describe the required background of responsible persons in statement preparation, and (3) to define the time and staff required to prepare adequate, useful statements.

VI. RECOMMENDATIONS

The policies and guidelines of the Forest Service in regard to environmental legislation show generalized response toward management practices that prevent and control air and water pollution. However, the requirements of new legislation and new national policies and guidelines are not fully recognized. Many of the guidelines and policies are yet to be incorporated into operating procedures and interpreted into action.

The level of scientific knowledge is never adequate to provide perfect predicability of the expected consequence of forest resource decisions. This fact does not eliminate the responsibility to make full use of what is available and to work constantly toward improving predicability. Changing conditions, particularly those involving the changing expectations of people, make new and changing demands on the requirements and dimensions of knowledge required for forest management decisions.

This study has attempted to point out the strengths of the present management programs on the Flathead National Forest as well as to identify weaknesses and needed directions. The strengths and positive directions are encouraged and supported. It is the responsibility of this report to make recommendations to improve weaknesses in a realistic and logical manner.

It is not possible to judge whether or not the Flathead National Forest meets the environmental criteria established by law. It cannot be said to be operating consciously within the safe limits imposed by the natural environment because those limits have not been determined. There is little data on stream hydrology, soils, sedimentation, nutrient movement, channel scouring, productivity, or other information about the environment which might provide a basis for predicting the results of management activities. Ocular observation provides the present basis for determining results. Observation is always useful but it cannot provide the precision needed to conform to the new environmental laws.

Many studies and documents have been cited in this report that have made comprehensive recommendations to improve forest management practices. These recommendations can be reviewed by referring to documents identified herein. The recommendations developed in this report are intended to identify methods and approaches for accomplishing specific goals.

The changes needed to comply fully with the present and emerging requirements are considerable but not impossible. If the Flathead National Forest, or even the Forest Service as a whole, were required to meet these changes by itself, the task might well be impossible. However, the law provides for a widely based, coordinated approach of Federal, State and local agencies working with citizens to accomplish certain desirable goals. It calls for establishing new working relationships in accomplishing these goals.

The recommendations, if acted upon, will significantly increase the level of scientific knowledge necessary to respond adequately to the national environmental goals and policies that have been established by legislation and Executive order. The program outlined in the recommendations is recognized as not being all inclusive. They are intended as a beginning point, a prelude to more comprehensive and detailed program.

Recommendation I

Develop a coordinated air and water quality monitoring program among Federal and State agencies, for:

A. Air Quality

1. The Forest Service Regional Office (R1) should take the lead in meeting with State air quality personnel with the specific goal of having a system operating in the Flathead National Forest by the 1975 field season. This system should be designed for purposes of evaluating effects of slash-burning.
2. The Forest Service should develop a proposal for a system to predict emmission loading (particulates) from slash burns of varing intensity and varying fuel loading. This should be an effort of research with funding by EPA, State of Montana, and Forest Service programs.
3. Develop a reporting system to be used during slash burning periods to record information necessary for evaluating effects of slash-burning. The system need not be complex. This effort should be coordinated by the State of Montana with cooperation from EPA and all land management agencies involved in open burning. This should be in operation by the 1974 fall burning season.

B. Water Quality

1. The Flathead National Forest should design and establish a water quality monitoring system using the following parameters as a minimum:

Temperature
Dissolved Oxygen
pH
Suspended Solids
Flow
Turbidity
Specific Conductance

Additional parameters for recreation areas and municipal watersheds:

Coliform
BOD

The Environmental Protection Agency should assist in designing the monitoring system. Data from the system should be compatible and added to the EPA STORET System.

2. The Forest Service Regional Office (R1) in cooperation with the Intermountain Forest and Range Experiment Station should expand its program to establish a network of benchmark research and monitoring watersheds to provide the long run knowledge on the environmental effects of forest manipulation.

   The Coram Research Forest may be a convenient starting point, correlated with other watershed research established in the region by the Experiment Station. Work on the University of Montana Forest and Conservation Experiment Station, work at the University of Idaho and other universities can provide direct and continuing knowledge for the Flathead and other forests of the region.

   The "benchwork" program should be worked out cooperatively with other federal agencies, appropriate state and local agencies and institutions.

3. The Forest Service Washington Office develop a coordinated monitoring program, including benchmark and forest operational programs,

for the Rocky Mountain region. A group of universities from every state in this region working together as the Eisenhower Consortium and the Committee on Future Environments of the Rocky Mountians of The Institute of Ecology are presently carring out a study of research needs and priorities (Rocky Mountain Environmental Research - Quest for a Future). The study is funded by NSF-RANN, the Forest Service and EPA. The research inventory will prepare the way for broad-guage interdisciplinary research programs to be carried out cooperatively by universities and public agencies. The strength needed in such a broad and complicated field needs the critical mass provided by such cooperation.

4. The Flathead Forest should amplify its water quality monitoring system with temporary systems to monitor individual projects. Such systems have been recommended from time to time by specialists on the Flathead and from the regional office. Keyed to the monitoring system on the forest, such temporary systems can amplify the permanent system and accelerate knowledge accumulation.
5. The Forest Service Regional Office (R1) should initiate a workshop to review existing water quality standards to determine applicability to forest management. This workshop should identify needed changes and improvements. Involved agencies would be the State of Montana, The Environmental Protection Agency, and the Forest Service. This effort should lead to revision of standards or adoption of additional standards that may be more applicable to forest management activities.

Recommendation II

A. Develop relationships with EPA and the State of Montana in relation to nonpoint pollution. The Environmental Protection Agency should hold a workshop to discuss the study findings in relationship to the National Silvicultural Demonstration Project being carried out by EPA Region X. This workshop should include EPA Regions VIII and X, University of Montana Study Team, and Personnel from the Flathead National Forest and Northern Regional Office. This should be carried out as soon as possible to maximize benefit to the National Demonstration Project.

B. The EPA should prepare and present a briefing outlining the strategies and regulations for achieving prevention and control of nonpoint source water pollution. This should include key representatives from the Forest Service Regional Office and from individual forests in the region.

C. The State of Montana should prepare a briefing to outline the area-wide basin planning effort and identify needed input from forest management agencies. This should be carried out at a joint conference of involved agencies.

Recommendation III

Develop a comprehensive and cooperative data storage and retrieval system as an aid to the forest management decision process to include data on air and water quality. While it would be desireable to explore a number of available systems, the Timber RAM model now used in timber management has considerable possibilities for adaptation to include more comprehensive data storage and analysis. Both short run and long run plans should be initiated:

A. Short Run - There exists a great deal of knowledge, some of it being used some of it not, which can be made available and put into use in decision making. The systematic use of present knowledge is the best and fastest available method for strengthening the scientific basis for decision making on the Flathead Forest. To initiate this process two steps are needed:

   1. The Regional Office should make available to the Flathead Forest an analyst who is highly skilled in the use and potential applications of the RAM program and similar analytical methods, and assign him the task of quantifying available knowledge. Staff specialists should assist him by dedicating a reasonable amount of their time to help collect existing data from all possible sources--e.g., universities, government agencies, industrial firms, etc. Where existing information is simply unavailable or completely unreliable, the analyst should fall back on expert opinion, heuristics, or other forms of surrogate data. While a vital need exists for more and better information, it is abundantly clear that a great deal of existing information is not being used to maximum advantage. A good analyst on staff could do much to overcome this situation.
   2. The EPA and Forest Service should provide for a workshop involving the RAM expert, the Flathead staff, regional staff, experts from

universities, other agencies and other appropriate groups to help in gathering and making data available. A side benefit of the workshop would be the identification of critical information needs that could be passed on to researchers in the Forest Service and at universities.

B. Long Run - Refinement of knowledge, data storage and retrieval and its use in decision making needs to become a continuing process. Exploration of new systems, their use by field administrators and continued feedback to research and other knowledge sources should become part of standard operation. To be most effective the process needs to be coordinated with all appropriate agencies and institutions.

Recommendation IV

The Flathead National Forest should increase the number of staff specialists and provide greater opportunity for education, development, and effectiveness.

A. Additional specialists are needed to carry on new and expanded functions:
    1. To install and maintain monitoring systems
    2. To make preliminary studies of planned projects
    3. To review completed projects
    4. To make inventories needed for long range planning
    5. To communicate knowledge to and train field personnel
    6. To identify and relate research needs to appropriate organizations
    7. To translate research results and other available knowledge to field use.

B. More opportunities for self-development need to be provided for specialists:

1. To attend professional meetings
2. To meet with other specialists from other forests and regions
3. To observe work in other areas
4. To attend refresher courses or enroll for advanced work
5. To have access to current literature and time to assimilate it
6. To generally have more interchange with people in their field

C. Additional specialists are needed in several fields

1. Soil scientists and hydrologists were most frequently mentioned
2. The need for fisheries biologists may not appear so obvious but the need should be emphasized. An important part of water quality monitoring involves biological considerations. The fisheries biologist is best qualified to identify and measure these. Frequent mention was made in Flathead plans and reports that the critical consideration in water quality was for the welfare of the native cutthroat trout. This fish appears to be the critical natural monitor of water quality in the Flathead. This fact emphasizes the need for fisheries biologists.

D. Communication between specialists and decision makers should be strengthened. While it appeared to be generally good, some further coordination seems desireable, especially as more specialists are added to the staff.

1. A coordinator of substantive staff recommendations would serve to strengthen and clarify specialist recommendations. While the

deputy Supervisor now coordinates the activities and recommendations of the specialists just as he does those of other program staff, a coordinator of the scientific areas would help to balance the recommendations of the specialists and put them in better perspective. Such a man would have to be a generalist in a sense but well enough based in the scientific areas to command the respect and cooperation of the specialists on the one hand and with an understanding of the Forest Service programs on the other. Such a man might be hard to find and would require specific training for the job.

2. Opportunities for interchange of information and training programs between administrators and specialists should be emphasized. As each keeps the other informed of his activities, plans, and progress general effectiveness and job satisfaction will remain high.

Recommendation V

The Flathead National Forest should shift more manpower to accelerate the vital resource inventory needed for well based planning. The planning process is suffering from lack of factual on-site data needed to translate planning into responsible action. If additional manpower cannot be made available, some of the effort now devoted to planning should be shifted to data gathering in order to achieve a better balance needed to shore up the planning process.

Recommendation VI

The Flathead National Forest with support of the Regional Office should expand cooperative relationships and public participation in planning and operations. Cumulative effects of all programs must be recognized, effects are accelerating and their interrelationships are becoming more complicated. With Flathead Lake the focus of this growth, the importance of water becomes primary in management decision. The example of Lake Tahoe vividly illustrates the need for careful, integrated planning as a coordinated effort of all agencies in the Flathead Valley.

A number of areas for cooperation are apparent:

A. In conjunction with establishing the air and water quality monitoring program for the Flathead National Forest in cooperation with other Federal, State and local agencies, comparative programs should be initiated on three other national forest in the region. The State is proposing a coordinated monitoring program of State agencies (EQC, 1973 annual report), which should be the nucleus of a coordinated program involving Federal agencies. Methods, procedures, responsibilities and financing would need to be developed. Data storage and retrieval systems could be developed. Goals, standards, criteria and management recommendations could evolve from the results of such a program.

B. In connection with the new timber management plan to be developed for the Flathead National Forest during the next eighteen months, the Forest Service should invite cooperation from other agencies, universities and others to develop a new program that will provide additional information and a multiple use approach to forest management. This interdisciplinary approach should be expanded and used for other operations on the Forest as directed by NEPA. The cooperative arrangements should include the preparation of environmental impact statements, long range plans, inspections, and programs in substantive areas, e.g., timber sales, road layout and construction, soils, hydrology, wildlife, range and fisheries. The Flathead could serve as a pilot area to develop cooperative interdisciplinary programs on the national forests which would greatly expand the sources of knowledge for national forest management.

C. The Forest Service should work with Federal and State agencies to develop responsibility for enforcement to meet new requirements on a cooperative basis with State and Federal agencies involved. (an inspection-review system)

D. The process of public participation should be encouraged and expanded to include such topics as: the assumptions on which the annual allowable cut is based; the cause and effect relationships of roads and timber harvesting and the precautions being taken; forest stratification; resource inventories; plans and program; the policies and guidelines under which the Forest Service operates; enforcement procedures, and other matters.

Recommendation VII

The expertise available at all levels in the Forest Service should be fully utilized to expand the scientific approach to environmental management.

Hydrologists, soils scientists, geologists, biologists, silviculturists as well as administrative staff have at various times recommended that monitoring be done. They have recommended new policy statements and they have urged the expansion of scientific staff. This is the normal growth, the expected reaction of new lines of staff in an organization. The administrator has to balance these demands with the many others he encounters. The existence of such a staff, pushing for greater responsibility within the organization, displays strength in these fields that can easily be built upon.

Recommendation VIII

The staff of the Flathead National Forest should be given freedom and authority to develop programs (including levels of timber harvest) and needed budgets to meet established needs and priorities from an understanding of local conditions.

Recommendation IX

The programs so developed should be authorized and the budgets funded by higher levels at the Forest Service and the Office of Management and Budget.

Recommendation X

The Congress should authorize and fund and the Administration direct the Office of Management and Budget to fully support a new program for the Forest Service directed toward environmental management of all forest resources (Spurr, 1974). Such a program to include:

a. An assessment of anticipated demand and supply, possibilities for improvement, programs, policies, and research.

b. A new and expanded inventory system of all lands and resources on an integrated basis.

c. An expanded resource planning program, coordinated with other agencies, Federal, State and local.

d. A national forest program which recognizes the requirements of resources: air, fish and wildlife, grazing, recreation, soil, timber, water, in an optimum way suited to the needs of each forest.

e. The funding necessary to carry out such a program.

Funding in the past has been directed toward consumption of old growth timber, a depleting activity (Clawson, 1974). The new program for management of the total forest resource needs to be aimed at productive activities which should have a cumulative effect of forest improvement in all aspects including the environment.

VII. SUMMARY

The study of "Policies, Guidelines and Enforcement Procedures Affecting Prevention, Control and Abatement of Air and Water Pollution Resulting from Forestry Practices on the Flathead National Forest, Montana," analyzed the response to recent Federal legislation. Of special concern was the provision for identification and control of nonpoint sources of water pollution as required in the Federal Water Pollution Control Act Amendments of 1972. The study also analyzed response to the Clean Air Act, the National Environmental Policy Act, and related Executive orders and guidelines.

The Forest Service is aware of the laws, but specific policy and guidelines for the Water Pollution Control Act Amendments of 1972 have not yet appeared. Mentioned so far only in the hydrology handbook, water pollution control standards do not have direction from Washington or the Regional Office. There is no awareness of them yet on the Flathead Forest because no direction has come to the field. No effort has yet been made to work with the State in setting up an areawide waste treatment planning process in the Flathead Valley. By contrast, an agreement on slash burning has been worked out with the responsible State agencies and is in operation. The Flathead is aware of the fact that the State may halt slash burning and is working on alternative methods of slash disposal.

The most significant determinants of nonpoint-source air and water pollution were found to be the magnitude and character of forestry operations, primarily timber harvesting and road building. As a consequence of these activities, watershed balances may be and have been upset and there is evidence of accelerated erosion and siltation.

The Flathead National Forest is primarily in the timber production and road construction business. Therefore, with respect to air and water pollution, the Flathead is in a "high risk" category.

Intolerable levels of water pollution have been generated in the past, as documented in Forest Service records. There is evidence that the primary cause of pollution has been the past character of timber harvesting and road building. The magnitude of harvesting and road building remains essentially the same today; if this magnitude is to be maintained, significant improvements in the character of management will be necessary. The Flathead National Forest has recognized this, and has made a noteworthy beginning. It is aware that in order to maintain the present level of timber production, harvest will have to be pushed into areas of greater risk environmentally.

A number of steps have been taken to reduce the adverse effects of timber harvest and road construction. The steps that have been taken are significant. An interdisciplinary approach to problem identification and solution is provided by a staff of specialists in various resource areas. New practices and procedures recommended by these experts have been instituted. However, there is still a lack of data to prove or disprove the environmental results of forest activities.

At various times Forest personnel have urged monitoring to obtain knowledge of the effects of forest practices, but at this time almost none have been initiated. There are virtually no data on stream hydrology, soils, sedimentation, nutrient movement, channel scouring, and productivity.

In short, there is no information about the environment that might provide the Forest staff with some reasonable basis for predicting the results of its activities. Passive observation provides the present basis for determining results. Observation is always useful but it cannot provide the precision needed to conform to the new environmental laws.

The Flathead Forest cannot be said to be operating consciously within the safe limits imposed by the natural environment, because these limits have not been determined; and there was no evidence of an effort to determine these limits. The process of timber inventory and estimation of allowable cut were examined, and the basis for environmentally sound timber management did not appear to be adequate. Lack of knowledge makes it impossible to determine the direct or indirect effects of forest activity. Little if any consideration is given to cumulative effects. Some attempt is made at restoring previous damage but there appears to be no continuing program. In fact, except for observation, there is no measurement of the extent of past damage. No effort has been made to supply the data needed by the State because there is little to offer.

There were instances in which Forest Service timber management practices were undertaken on the basis of a dangerous environmental strategy: the assumption of the environmental adequacy of practices in the absence of contrary proof. This appeared to be a matter of agency policy, not peculiar to the Flathead. This strategy is in direct conflict with the National Environmental Policy Act, and needs to be reversed: practices should not be undertaken until they are proven safe.

The weakness of data on cause-and-effect relationships was most evident in the consideration of alternatives in the environmental impact statements. No rational range for decision was identified, and no proof was given that the limited alternatives presented were within that range. Without such knowledge, the statements became justifications rather than true evaluations.

The statements are full of justification for cutting, supported by a considerable amount of data on timber volumes and growth, while information on the soil, water, geology, and vegetation is meager, particularly as to the effects of manipulation.

Knowledge provides for considering a range of alternatives and also identifies the safe limits of manipulation within which activities can operate without environmental damage. It does impose restrictions on activities but these restrictions are now called for by law. The effect of the new legislation is to require a knowledge base for sound management not only for environmental protection but for sustained yields of all the goods and services derived from the forest.

To operate legally, the Forest Service must develop a system for gathering knowledge by a greatly improved inventory of the whole forest, not just the timber; it must monitor and evaluate cause and effect relationships; it must organize knowledge so that it can be easily retrieved and used by the decision maker. The decision maker, in turn, must make visible decisions which can be analyzed for improvement. By doing so, the forester can take his place as a responsible decision maker and earn the credibility which has been lacking. The Forest Service must become engaged deliberately and directly in the pollution control business: it is a matter of law, not choice.

The long range planning program of the Flathead has much merit and can be adapted to the study team's recommendations. It starts with generalized virtue and gives promice of providing specific answers sometime later. This it can do if it goes far enough, but it cannot go far enough under the present state of knowledge. The planning program can be prepared, however, for the inclusion of the necessary information at a later data. Meanwhile it should give plenty of leeway for lack of knowledge and the attendant uncertainities.

Specific pollution control decisions under the new organization are to be made in the field, and general policy platitudes are largely inescapable at the Washington, regional and forest levels. But the field decisions were found to be as broad and general as the Washington office pronouncements. The generalities expressed in the EIS's on timber management and roads were also to become specific on the job. But again, the information is not available for doing that except in a very general way.

By adding a stage III, IV or V to the long-range planning program, arrangements can be made to develop the necessary knowledge. This could start by accumulating the facts now available, with proper help. In so doing, particular attention must be paid to the information gaps. In this manner the planning program can help identify the need for knowledge as a guide for research. It should also provide for data development on the Forest; by monitoring, and by recording facts gleaned in actual operations, the Forest can become its own knowledge source.

The new legislation requires new cooperative relationships with other Federal agencies, state agencies, universities, and the public. The Forest Service has tended to remain technically and professionally isolated and autonomous. New cooperative programs need to be developed.

The Flathead should be drawing on outside help at every opportunity to improve its interdisciplinary approach. It should draw on such help in its new timber management plan, starting with a new inventory system that accounts for all forest resources and values. The weakness of forest management in the Forest Service has been the weakness of its single-resource inventories augmented by its assumptions, hidden or declared, on how the data are used.

The recommendations offered by the study team are aimed first at developing knowledge and systems for making knowledge available to the decision makers. Secondly, they emphasize coordinated effort in monitoring, planning, and management programs. And, finally they call for a new program for broad based, responsible management of the National Forests and the necessary funding to carry it out.

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APPENDIX A

SOME RECENT PROPOSED POLICY STATEMENTS AND GUIDELINES FROM THE FLATHEAD NATIONAL FOREST AND THE REGION I OFFICE OF THE FOREST SERVICE

Flathead National Forest
Kalispell, Montana 59901

2500 Watershed
1440 Inspection

November 24, 1972

Water Quality Goals

Dave Minister
Program Coordinator

One of the Water Quality Goals the Region should establish is a definite objective. So little has been done in the field of water quality that it is difficult to develop a definitve goal. On the Flathead National Forest, turbidity analysis was carried on for a number of years. There was no objective established for the sampling and analysis program. There was no interpretation of the data once it was analyzed.

Very little water quality data had been collected on the three rivers prior to the start of the Wild Rivers Study. Consequently, it was decided to establish sampling points at or near U. S. Geological Survey stream gaging stations. Seven points were selected and samples collected by U. S. Geological Survey personnel from July 13 to July 16, 1970. The purpose of this project was a complete sampling to isolate any problem areas. The seven sampling points selected were:

1. South Fork of the Flathead above Harrison Creek.
2. South Fork of the Flathead above Twin Creek.
3. North Fork of the Flathead at the British Columbia border.
4. Middle Fork of the Flathead above Bear Creek.
5. Middle Fork of the Flathead at West Glacier.
6. Flathead River at Columbia Falls.
7. Flathead River near Columbia Falls at the stream gaging station.

The samples were sent to the U. S. Geological Survey water lab at Austin, Texas, for insecticide and herbicide analysis. Sediment analysis was done at the lab in Worland, Wyoming, and carbon samples were sent to Washington, D. C. Other parameters were analyzed by the water quality lab at Lincoln, Nebraska.

The parameters analyzed were:

Insecticiess

Aldrin
DDD
DDE
DDT

Herbicides

2, 4-D
Silvex
2, 4, 5-T

Dieldrin
Endrin
Heptachlor
Heptachlor epoxide
Parathion
Methyl Parathion
Diazinon

All insecticide and herbicide analysis produced negative results. Other parameters for which the samples were analyzed included:

Silica
Aluminum
Iron
Manganese
Calcium
Magnesium
Strontium
Sodium
Lithium
Potassium

Bicarbonate
Carbonate
Alkalinity or CO_3
Sulfate
Chloride
Fluoride
Nitrate
Dissolved ortho-phosphate
Boron

Conductivity
Total alkalinity
Total hardness

pH
Nitrate
Noncarbonate hardness

Temperature
Arsenic
*Beryllium
*Total chromium
Copper
*Nickel
*Silver
Total phosphate
Dissolved solids
CAL dissolved solids

*Barium
*Cadnium
*Cobalt
*Lead
Molybdenum
Selenium
Carbon dioxide

(*indicates 0.00 values in all cases)

This analysis revealed no significant problem or reason to continue with total analysis. Field sampling for the following parameters, which was begun for some stations as early as August 1969, was continued:

Temperature
pH
Specific conductance
Total coliform
Dissolved oxygen

Turbidity
Total alkalinity
Total hardness
Aesthetic appearance
Odor
Deleterious substances
Suspended sediments

The sample site on the Flathead River near Columbia Falls at the gaging station was dropped. A site on the Middle Fork at Schafer Guard Station was added. A Hach portable water lab model DR-EL was used for field analysis. This model produces reliable results for detecting trends in water quality. (McKee and Boar, an evaluation of Hach direct reading engineer's laboratory, Lab. Invest. Series, FW PCA, Cincinnati, Ohio.

Sample sites at Harrison Creek, Bear Creek, and Schafer essentially reflect "natural" conditions in that there is little man-caused activity above these sites. The sites at West Glacier and Twin Creek are affected by road construction and logging. The site at the British Columbia border on the North Fork is an indication of the water quality when it enters the Forest. This is important in that the North Fork is the only one of the three rivers that does not originate on the Flathead Forest. A total integration of all three rivers is measured at the Columbia Falls site.

Water quality was generally good. Turbidity fluctuated with volume of flow, temperatures and dissolved oxygen with time of year. Table 1 presents the range of values determined as well as the number of times each site is sampled. Samples were taken during peak flows, base flows, late fall/early winter, and late winter/early spring.

The sampling system established for the wild rivers study will be continued as a watershed management project on the Forest. This will provide continuing refinement to the data as well as monitoring the river system.

It is not likely that any river-oriented recreation activities would be precluded because of water quality problems on the three rivers. Increased turbidity during peak flows might curtail some activities; however, weather is usually poor during this period so that river use is low. Most recreation activities are limited by climate and season and not water quality.

Table 3 - Range of Values determined for selected water quality parameters for seven stations within the Flathead Wild Rivers Study Area.

	Harrison	Twin	Schafer	Bear	W. Glac.	Col. Falls	B. C.
Inclusive Dates	6/2/70-8/18/72	8/15/69- 8/30/71	6/2/70- 10/16/72	5/13/70- 9/17/72	9/23/69- 8/17/72	5/14/70- 8/17/72	5/14/70- 10/16/72
No. of Samples	7	10	8	9	12	11	9
pH	8-9	8-8.5	8-8.7	8-8.5 3/	7.9-8.7	8.1-8.6	7.8-8.8
Spec. Cond. (MMHOS)	140-340	140-210	162-340	180-260	130-240	138-220	132-270
Dis. O (mg/l) 1/	8.5-16	8-16	8-15	8-14.5	8-14	10-14	8-15
Turb. (J.T.U.)	0-65	0-400 2/	0-58	0-65	0-95	0-80	0-80
Total Alk. (mg/l)	60-137	70-137	95-205	75-125	60-110	60-100	75-160
Total Hard. (mg/l)	60-188	60-137	70-160	65-130	70-105	70-90	75-160
Total Coliform (col/100ml)	0-5.1	0	0-7	0-4	0-4	0-5.1	0-75
Sus. Sed. (mg/l)	0-60	4-197	0-101	0-13	0-252	0-29	0-17

1/ Dissolved oxygen ranges are due primarily to fluctuations in water temperature. Values range from 75-130% saturation.

2/ 400 JTU was recorded on 5/28/70 during spring runoff. This site is 1/4 mile downstream from a large road cut that is a sediment source during high flows and rain storms (See Photos 4 and 5). Suspended sediment analysis of this sample measured 197 mg/l.

3/ There was one pH value of 6.7, which is probably a sampling error.

The capacity of the river to purify itself is excellent. Normal biochemical oxygen demand is very low as evidenced by oxygen levels at or near saturation throughout the year. All three rivers have good pool/riffle ratios, rough bottom, and relatively rapid velocities providing ample recreation. If there is no increase in organic load into the rivers, water quality will remain excellent.

Generally speaking, the possibility of bacterial infection due to use of untreated water from the three rivers is remote. In a study on the North Fork, Sonstelie reports that the major tributaries are low in total coliform count. 1/ The study revealed some possible problem areas that should be further investigated.

Sources of Sediment and Pollution

All three rivers carry a relatively heavy sediment load during high flows. This can be observed by visually inspecting the rivers during high flow and then again during low flows. The sediment sources are primarily the glacial material through which each river passes. The rivers undercut steep-walled banks until large portions of vegetation, rocks and soil are deposited in the channel. This is a naturally occurring process and would be difficult if not impossible to stop. Attempts to control natural erosion would require rehabilitation projects not in keeping with the wild river classification.

Additional sedimentation occurs from road construction and timber harvesting. Some of these sources could be eliminated with rehabilitation projects. Future problems can be avoided with proper planning concerning road location and silvicultural methods used in timber harvest.

Sheet and gully erosion is minor to non-existent within the study area. The entire study area lies within a low potential erosion hazard area. (Pacific N.W. Rivers Basin Com., 1971, App. VIII, 1, p. 145, Fig. 10) Potential sediment yield from forest land without protective measures is estimated to be less than .2 acre feet/mi. (Pacific N.W. River Basin, Com., 1971, VIII, 1, p. 144, Tab. 78). While this is a low per square mile figure, the total volume possible is significant. Consequently, it is important to take erosion control measures on all timber-harvesting activities.

Sources of probable fecal contamination in the study area are campgrounds, administrative sites, and areas where big game animals concentrate.

The entire study area lies within the State of Montana and is subject to water quality standards established by the Montana Water Resources Board. The State standards provide a guide for water quality management; however, there are some shortcomings. Dissolved oxygen standards, for example, should be reflected in percent saturation as well as absolute values in milligram/liter. Absolute values fluctuate with temperature, and most temperature changes in the study area are natural.

1/ Sonstelic - Personal communication - 1971.

The standards refer to natural levels; however, there is no criteria for determining natural levels. The field checking done on the wild rivers study provides an indication as to naturally occurring levels; however, there is little statistical reliability to the sampling and testing procedure.

Another problem involved with using absolute values is that the standards for turbidity are violated frequently during road construction. Installation of a culvert in a live stream temporarily will raise turbidity levels beyond maximum allowable limits. The same could be said about bridge construction and other projects associated with timber harvesting and road construction. A more realistic set of standards would set limits based on values per volume of water per time. Improvement of water quality on the three rivers is not so important as maintaining the high level now present.

Man-caused sediment sources can be corrected by rehabilitation and protection measurements. Future management activities can virtually eliminate man-caused sediment sources through utilization of proper land management activities. The Pacific Northwest River Basin Commission has estimated some costs for these measures. These are presented in Table 2.

Table 2 - Estimated Costs for Watershed Protection Practices on Forest Land in the Flathead Wild Rivers' Study Area (Table 88, App. VIII, Pac. N.W. River Basins' Com., 1971).

Practices	Unit	Cost/Unit
Logging Disturbance Treatment	Acre	$ 30.00
Harvest Road Treatment 1/	Mile	$250.00
Other Watershed Requirements 2/	Acre	$ 19.00

1/ Includes road maintenance.

2/ Includes watershed surveys, prescription and plans, fire protection, timber cultural practices, special road requirements, and other indirectly related factors.

CONCLUSIONS

1. Field analysis with the Hach kit may not be producing sufficient accuracy even for trend determination. Field analysis should be in conjunction with lab analysis in order to develop confidence limits for the field determination.

2. The Forest needs assistance in establishing sample sites, sample frequency, and sample parameters.
3. Determination of naturally occurring sediment loads is especially important to the Flathead.
4. Adequate funding and personnel are needed to do the job.

ROBERT G. DELK
Hydrologist

RGDelk:da

2500 Watershed

January 22, 1973

Proposal for Regional Water Policy and Hydromet System

Regional Forester

In our meeting with you last spring, you invited comments from the field. In response to this invitation, the Forest Hydrologists of the Northern Region, as a group, respectfully submit these comments and recommendations.

We are concerned about the passive attitude towards the water resource which prevails under current multiple-use management and planning within the Northern Region. Although the importance of water has been recognized since the inception of the Forest Service, the land manager today all too often feels that "water comes anyway without our help--why worry;" or water is merely a design consideration for roads and timber sales. We believe this attitude exists because a more positive and dynamic Regional water policy is lacking.

It is our opinion that watershed management is in reality multiple-use management applied to a watershed, and that the effects of the multiple-use management can be measured by changes in water quality, quantity, and timing of flow from the watershed. In this sense monitoring the water resource is a quality control for the multiple-use management. By the same token, this measurement of the water resource provides the hydrologic information necessary in multiple-use long range planning as well as project level planning. Without this basic hydrologic information it is impossible to inventory the water resource itself against the likelihood of increased user demands in the future.

For the above reasons we strongly urge the establishment of Regional policy spelling out the role of the water resource in multiple-use management. If Regional policy concerning water is limited to "keep it relatively clean" following land management activities, then it should be so stated. We feel, however, that water should be recognized as being a natural resource to be managed along with timber, wildlife, range, and recreation. We, therefore, recommend a policy statement to include:

Water is a valuable resource of the forest and range lands of the Northern Region. It is the policy of the Northern Region of the U. S. Forest Service that multiple-use plans will include provisions to:

1. Protect the existing high water quality;
2. Increase the amount of water when a need is demonstrated;
3. Modify the timing of water flow if the need is demonstrated and the technique developed.
4. Improve water quality in degraded streams.

No policy statement is any better than the means to implement it. The implementation of this policy recommendation will require an aggressive program to collect and analyze hydrologic data for establishing baseline information to guide multiple-use management. As pointed out in the recent Dils' Report, the basic hydrologic inventory is sadly lacking. Several advanced techniques are available to facilitate the collection and analysis program, but have not been widely used in the Region. These techniques include a variety of specialized instruments designed to measure various hydrologic and meteorologic parameters. Remote sensing and telemetry systems are also available. Simulation models and other computer applications, already developed, could be used if the basic hydrologic data were available.

Implied in a commitment to a sound hydrological and meteorological (hydromet) collection and analysis program would be the funding and personnel to do the job. Each forest would have different funding requirements that could be evaluated individually. Each forest would need at least one full-time technician in the GS-5-9 category. It is possible that joint hydromet programs with Forest Service research, universities, and private concerns could be developed, as suggested in the Dils' Report. We strongly recommend that the Regional Forester give high priority to establishing a hydromet program. We realize that if money is made available for a hydromet program, another program may suffer at least temporarily, but the long-term benefit of a hydrmet program would outweigh any short-term disadvantage. We feel this is a "must do" priority.

In summary, we have the firm conviction that if these recommendations are adopted, the Northern Region can fully redeem the original Forest Service mandate of "securing favorable conditions of water flow" for the "future good of all people".

/s/ Clifford R. Benoit
CLIFFORD R. BENOIT
Northern Region

/s/ Jack L. Craven
JACK L. CRAVEN
Custer National Forest

/s/ Robert G. Delk
ROBERT G. DELK
Flathead National Forest

/s/ James E. Eggleston
JAMES E. EGGLESTON
Northern Region

/s/ Robert S. Embry, Jr.
ROBERT S. EMBRY, JR.
St. Joe National Forest

/s/ Alan F. Galbraith
ALAN F. GALBRAITH
Kootenai National Forest

/s/ Herbert S. Garn
HERBERT S. GARN
Bitterroot National Forest

/s/ J. Allen Isaacson
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Nezperce National Forest

/s/ Richard H. Wheeler
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RGDelk:da

Department of Health and Environmental Sciences
STATE OF MONTANA HELENA, MONTANA 59601

John S. Anderson M.D.
DIRECTOR

November 20, 1973

Dr. Arnold Bolle
School of Forestry
University of Montana
Missoula, MT 59801

Dear Dr. Bolle:

Pursuant to your November 19, 1973 conversation with Don Willems of this office, I have been requested to outline our cooperative water sampling program.

Beginning this past spring, we began analyzing stream and lake samples collected by the Beaverhead and Helena National Forests and the Soil Conservation Service. Because of a general lack of water quality data in Montana, the agreement is informal and quite open-ended. Basically, we analyze and then share the results on any sample submitted. Since the above agencies are most familiar with drainages in their jurisdiction, when and where to sample is their prerogative. Generally, we have been analyzing for common chemical constituents, pH, specific conductivity, plus selected heavy metals.

I doubt that many definite conclusions have been drawn because of the brief sampling period. However, you may want to contact people we have been working with. They are Walter Page (Beaverhead National Forest, Dillon), Charles Harnish (Helena National Forest, Helena), and Phillip Farnes (SCS, Bozeman).

Unfortunately, our present laboratory capability does not permit additional cooperative sampling at present. However, I hope this is only temporary. Lewis and Clark, Gallatin, and Flathead National Forests have also expressed interest in cooperative sampling/analysis. I'm sure that others would be similarly interested.

Sincerely,

Robert D Braico

Robert D. Braico
Water Quality Bureau
Environmental Sciences Division

RDB:vlf

From FSM 2509.21 - Region 1 Handbook on Water Quality Surveys
(in "draft status," November 29, 1973)

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CHAPTER 100 - OBJECTIVES

This handbook assembles subject matter standards and guides for a water quality survey, sampling criteria and standards, definition of terms, and other operational guidelines. These are aimed at obtaining comparable information on effects of land management activities on the water resource and providing a basis for appraising the water quality situation on the National Forests and Grasslands.

The general objective of the water quality survey is to determine the facts regarding the present water resource and to develop from such facts sound technical interpretation that will provide the land manager a defensible basis for policy and program decisions. This requires the collection of basic information on the condition of the water resource: volume, quality, and location of water supplies; land and water uses, current, trends, and potential; and related information which bears upon the local water resource.

The effects of land management activities on the quality of the water resource are to be adequately analyzed and interpreted, and the findings issued promptly.

The information in this handbook is currently up-to-date. It may be revised periodically to reflect new and improved procedures. Your assistance is requested to help keep this current. Send your suggestion to the Water Quality Section, Earth Sciences Unit, Division of Natural Resources, Regional Office.

CHAPTER 200 - INTRODUCTION

Recent Federal and State legislation, the resurrection of historical legislation, executive orders, policy statements, courtroom encounters, congressional investigations, in-Service studies, and others have emphasized the need to reevaluate ourselves, our activities and priorities, and even our basic philosophies to protect and enhance our environment. Man has caused changes in the environment, many of which affect the relationship between man and his environment.

In order to protect and enhance our environment, we must attain a balance with respect to time. Our land, air, and water have a capacity to biologically and mechanically cleanse themselves. Man has historically viewed these resources as receptacles of infinite capacity. He is learning that with today's population and the demands for products and services, this is no longer true, if it ever really was. If the ecosystem becomes chronically overloaded, its ability to function can be irreversibly reduced. Vast natural systems may be severely damaged by the improvident intervention of man.

200.1 - Water Quality

One measure of the quality of our environment is the quality of our water resource. Early concern of water quality concentrated on eliminating poor sanitation which encouraged waterborne diseases that periodically ravaged the population centers of the world. These problems are now largely under control. The energies which demanded that solution is now being directed toward a broader concern for the entire environment, though not always in direct proportion to the seriousness of the problem. Recent concern for the quality of our waters centers on three aspects:

1. Growth of our industries and cities has multiplied the water quality problems in many of our waters.
2. The demand for outdoor recreation has grown in a society increasingly affluent and leisure oriented.
3. Man has an inexplicable affinity for water.

Two natural factors are generally responsible for determining the quality of our waters: (1) the mineral structure of geological strata, and (2) the chemistry of the surface soils. These are supplemented by waste effluent from our agricultural, including forest related, industrial and municipal activities. Man has little control over the mineral and soil qualities, but he does have the potential technical knowledge and engineering capability to control the quality of his waste effluent. In the interim, we are faced with uncertainties. To reduce the unpleasant consequences during the period of uncertainty, we can:

1. Conserve our resources for a "rainy day."
2. Keep open as many options as possible.
3. Avoid reaching an irreversible process.
4. Concentrate on learning how to remove the uncertainty.

No matter what the quality of our waters are, we pay for it--poor quality reduces productivity and the cost to restore the quality may well exceed the cost to maintain the natural quality.

200.2 - Forest Service Responsibility Toward Water Quality. The passage by Congress on October 18, 1972, of the Federal Water Pollution Control Amendments of 1972 (PL 92-500, 86 Stat.) signals growing national concern over the quality of the waters of the United States. This concern is directed at the public, especially Federal agencies, as well as the private sector. Section 313 (86 Stat.) states "Each department, agency, or instrumentality of the executive, legislative, and judicial branches of the Federal Government (1) having jurisdiction over any property or facility, or (2) engaged in any activity resulting, or which may result, in the discharge or runoff of pollutants shall comply with Federal, State, interstate, and local requirements respecting control and abatement of pollution to the same extent that any person is subject to such requirements, . . ."

The Forest Service will now be the object of a watchdog agency, the Environmental Protection Agency, to insure the Forest Service makes a reasonable effort to minimize unfavorable effects of land management on the aquatic resource. This EPA role is spelled out in Sec. 304(e) (PL 92-500, 86 Stat.). It states: "The Administrator ... shall issue to appropriate Federal ... agencies information including (1) Guidelines for identifying and evaluating the nature and extent of non-point sources of pollutants,and (2) processes, procedures, and methods to control pollution resulting from - (A) agricultural and silvicultural activities ...; (B) mining activities ...; (C) all construction activity ...; ..." This legislative direction encourages the Forest Service to exert leadership in its area of responsibility to reduce the chance EPA reviews of Forest Service management practices will limit viable management options.

These recent amendments now require all States to establish water quality criteria and standards for all surface waters of the United States, not just the interstate waters (Sec. 303(a), 86 Stat.). When approved by EPA, these State standards will become Federally-recognized. However, there are review procedures to modify existing standards and adopt new ones (Sec. 303(c), 86 Stat.) as supporting data becomes available or uses change. The application of water quality standards to all surface waters has undoubtedly influenced the Washington Office interpretation of navigable waters. As defined (Sec. 502, 86 Stat.) it means "the waters of the United States, including the territorial seas," which is interpreted as all surface waters regardless of size. This interpretation will remain in effect pending further clarification by EPA or by the courts.

We are also subject to citizen suits (Sec. 505(a), 86 Stat.) for alleged "violation of (A) an effluent standard or limitation under this Act, or (B) an order issued by the Administrator or a State with respect to such a standard or limitation." This provision has not appeared in any previous amendment.

The National Environmental Policy Act of 1969 (PL 91-190) directs us to "utilize a systematic, interdisciplinary approach ... in planning and decision-making which may have an impact on man's environment" (Sec. 102A, 83 Stat. 853). We shall, in addition, "initiate and utilize ecological information in the planning and development of resource-oriented projects" (Sec. 102G, 83 Stat. 854).

The President in two Executive Orders (E.O. 11507, 11514) has directed all Federal agencies to insure its facilities and activities do not pollute the nation's waters.

E.O. 11507 directs all Federal agencies to ensure that all facilities under their jurisdiction are designed, operated, and maintained to conform to the standards in the Federal Water Pollution Control Act, as Amended, or to the purposes of the act. E.O. 11514 provides the "how":

1. Monitor, evaluate, and control on a continuing basis their activities so as to protect and enhance the quality of the environment. Incorporate this information into plans and programs.
2. Revise where necessary, our statutory authority, administrative regulations, policies, and procedures where they are deficient or inconsistent and where they discourage compliance with the purposes and provisions of the several environmentally oriented acts.

We are also directed to include the public in the decision-making process and to cooperate with other agencies, both State and Federal.

Such direction to all Federal agencies requires a formidable storehouse of data and knowledge to carry out. We are just beginning to realize the implication these acts and orders have upon our activities. What was sufficient in the past is no longer true. Our decisions must be based not on assumptions but on facts. We must take a systematic and interdisciplinary approach to arrive at our decisions. We must begin to appreciate the enormous interrelated complexities of the environmental systems. We will weigh the trade-offs of potential environmental and socioeconomic harm against the benefits of our decisions. We will look at alternatives and incorporate environmental safeguards into the basic design of our programs and activities.

One facet of this environmental awareness or consciousness is water quality. But the classic concern for the bacteriological, chemical, and physical constituents are no longer sufficient. We need to relate to the aquatic environment, basically a biological system, and to the uses of the water at points downstream. The National Forests are not expected to produce water of so high a quality that treatment for domestic or municipal uses is unnecessary. Neither can they produce waters so degraded due to man's activities they produce long-lasting undesirable effects.

APPENDIX B

POLICIES AND GUIDELINES CONCERNING AIR QUALITY RELATED TO PRESCRIBED BURNING IN FOREST RELATED ACTIVITIES

5153.13 - Prescribed Burning Plans.

Air Quality Guidelines. To help achieve necessary prescribed burning in the Northern Region with minimum impact on air quality while maintaining high quality standards employ the principles contained in the paper entitled "Principles of Smoke Dispersion from Prescribed Fires in the Northern Rocky Mountain Forests," by W. R. Beaufait and Owen Cramer. Through their use smoke from prescribed burning should disperse to create the least possible impact on air quality. But the guidelines are not to override all other factors in determining when and how to burn. Instead, they provide means to consider smoke management as essential for environmental quality along with silvicultural, hazard reduction, or other management needs of the land. Prescribed fire is all intentional burning including broadcast burning, dozer piles, range improvement burning, handpile burning, etc.

1. Constraints to be Considered on Individual Prescribed Fires. All forest burning will require special attention to weather forecasts. The Weather Service will continue to issue a daily forecast on TWX until November 1. During the slash burning period, the forecast will include the level of free air convection, winds aloft at 6000, 9000, and 12,000 feet, and the daily temperature, humidity and wind trends. In some cases, you should be able to apply these trends to your local weather measurements making it unnecessary to request an individual spot forecast for each and every burn. In order to prepare accurate spot forecasts the following is required.

a. Temperature, dry bulb and wet bulb.

b. Wind direction and velocity.

c. Indicate cloud coverage, thunderstorms, etc.

d. Take measurements between 1400 and 1600 at the site the day prior to the planned burn. Measurements for more than one day prior to burn may also be helpful, if available at time of request.

e. If hygroaerothermograph readings are being reported, be sure to note that wind velocities are per-hour averages.

f. Report maximum and minimum readings from-on-site hygrothermographs for previous 2- or 3-day period when available.

g. Use Fire Weather Special Forecast Request, form R1-5120-16 when making requests.

Review the AIR QUALITY GUIDELINES FOR PRESCRIBED BURNING and the PRINCIPLES OF SMOKE DISPERSION by Beaufait and Cramer before burning.

2. All burning plans will contain a section on expected smoke plume behavior to include convection column height, smoke plume direction, and drift smoke direction. (Refer to Figure 6 in the Principles package.)

At the time of ignition, fuels should be as dry as practical, consistent with burning objectives and existing fire control needs. Burning should be done when the intended fuel burns briskly and completely.

3. Except when control needs dictate otherwise, early to mid-afternoon burning is encouraged to attain maximum convection column height and smoke dispersal.

4. On sites where drift smoke may be a problem, ignition will be scheduled to minimize drift during conditions of downslope winds and low level smoke accumulation.

5. When burning during dry periods, mop up fires to the same standards used for extinguishing wildfires.

6. Maximum smoke dispersion is essential for all burning operations; however, burns planned upwind of any recreational areas, areas of habitation, main transportation routes, or other urban and industrial areas may require more stringent precaution measures.

7. Burns will be scheduled to avoid drift smoke accumulation in adjacent valleys. This may require extra action to mop up smoldering remnants when a clean burn is not attained as planned.

Reporting and Coordination

Coordination to prevent the accumulation of smoke from several burns in the same general locality or on a Forest will be the responsibility of the Forest Supervisor. Coordination of burning on a Regional basis will be by the Regional Fire Coordinator. He will keep track of all current burning in the Region, assess potential smoke pollution impacts and restrict burning when necessary to prevent problem areas from developing in the Region. In order for the Forest Supervisor and the Regional Coordinator to coordinate burning in their respective areas the following reporting schedule will be required.

All burning and planned burning will be reported daily to the Forest Supervisor and the Regional Office.

The Slash Burning Agreement

Slash burning is used in forestry to dispose of logging wastes for three purposes:

1. To reduce or remove fire hazards
2. To prepare seedbeds for the next stand of trees
3. To release nutrients for new growth

Slash burning usually is done in the fall after the severe fire danger is over. Because of the frequent temperature inversions in the fall, slash burning is a persistent cause of air pollution. To minimize the air pollution effects the forestry agencies have developed a system of burning:

1. Air Shed Delineation

    Three years ago western Montana and northern Idaho were divided into air sheds. An air shed is similar to a watershed in that it includes the area through which air tends to drift as dictated by prevailing winds, local winds, and the channeling effect of topography. The delineation of air sheds is a new technique and, no doubt, refinements and changes will occur as they are used further. Some examples of local airsheds are: Clark Fork Air Shed, Bitterroot Air Shed, Flathead Valley Air Shed and Swan Valley Air Shed.

    The purpose of the air shed delineation is to provide a smoke management area which is based upon where the smoke will likely go rather than by the geographic descriptions such as forest boundaries, counties, etc. This appears to make sense because conditions vary between adjacent airsheds and smoke management manipulations could be confined to airsheds and thus be more flexible and also manageable.

2. Agency Cooperation

The agencies within each separate airshed have cooperated in the smoke management effort. They include the U. S. Forest Service, Bureau of Land Management, Bureau of Indian Affairs, State Forester, County Governments and private forest industries particularly those owning large acreage of forest lands. The cooperating agencies elect a monitor whose duty it is to keep track of the slash burning, to watch smoke accumulation in his air shed, and to advise districts that burning whether or not they need to shut down. There is such a monitor in the Flathead Valley Air Shed.

3. Burn Day Minus One

The district or management unit which intends to burn informs the Forest Supervisor and the Regional Office of the area planned for burning. Teletype communications between the Regional Forester's Office and the State Air Quality Control Office in Helena are used for informing each other on areas proposed for tomorrow's burning and visa versa. If the Helena office has reason to curtail such burning, they can.

The district doing the burning has already prepared a burning plan for each and every unit of land that is to be burned in a given season. This plan contains:

Total area to be burned
Name of each sale area
Name of each cutting unit
Estimated date for burning (within two weeks),
Type of burning (pile and burn, broadcast, row, etc.)
Water scource
Boundary Protection (firebreaks)
Personnel (overhead and crew)
Equipment (vehicles, special equipment, tools, hand, power)
Safety training
Ignition procedures map (sequence of ignition, number)
On site weather parameters
    example winds 5 to 10 mph
    Fuel moisture 9% to 30%
    Relative humidity less than 30%
    Air unstable
    Precipitation - less than 1 in. prior to date
Time of burn

The plan is carried out as closely as possible remembering, however, that as the burn proceeds, changes in igniting sequence may be needed or that burning may have to be stopped should weather conditions change so that a poor burn was resulting.

4. Burn Day

On the day selected for burning a weather forecast is received giving:

a. mixing level

b. wind direction and velocity

c. temperature and relative humidity

d. atmospheric stability

After the weather forecast is received, the district person decides whether to burn or not. He makes this decision from the forecast to see if the following conditions can be met:

a. is the area high enough so the smoke can reach the mixing level?

b. is the wind direction such that the smoke can miss any smoke sensitive places?

c. can the burn be completed in time to avoid a night-time inversion?

d. is the temperature high enough and the relative humidity low enough for a clean burn?

If the answers to these questions are favorable, then the burn is attempted.

5. How the System Works

a. Presently, all areas that are burned have had burning plans made for them.

b. Weather forecasts have been obtained and burn decisions made after the forecasts have been received.

c. Administrative offices have been duly informed of burns and the system has functioned reasonably well.

6. Special Events in the Flathead Air Shed

On the two occassions that were reported by the regional fire coordinator, smoke complaints were made for the Flathead Air Shed:

The first one came as a result of smoke from a wildfire in the Browning, Montana area. This was a very rare case because the smoke had come from the east to the west, which is against the prevailing winds and does not often occur.

The second instance came when smoke blew into the valley all the way from the St. Joe River area and from the Kootenai National Forest near Libby.

In both of these instances, no burning was being done on the Flathead Air Shed and yet smoke was coming in anyway. In cases like this the monitor called the Regional Office and burning was curtailed on air sheds adjacent to the Flathead and in a day or so the smoke had cleared and the burning could be resumed.

Material from: "Fire Quantification for Silvicultural Use" by William R. Beaufait and Charles E. Hardy, Northern Forest Fire Laboratory, Missoula.

Resource managers are not satisfied with the results of post logging treatment in respect to site preparation, hazard reduction, impact on the watershed, and air quality maintenance; hence the Miller Creek and Newman Ridge fire use studies from which this data comes.

1. The height attained by connection columns for 10 acre slash fires broadcast burned was found to be a function of:
    - a. mixing depth of the lower atmosphere
    - b. wind speed
    - c. buildup index

Neither the amount of fuel consumed nor the relative intensity of the fire significantly affected smoke convection column height. Buildup index appears to have by far the greatest influence on smoke column height, and mixing depth the least.

In order to get smoke dispersal above 11,000 feet, it is important that slash burning be done when the buildup index is at least 50 or more and the mixing depth is 9,000 feet or more. These conditions are readily found in the spring and early fall, but tend to be less and less available as the autumn progresses. This makes it all the more urgent to do as much slash burning as possible when the correct atmospheric conditions are present. This may also add to the cost of slash disposal.

Table 18.--Convection column height (feet mean sea level) as it varies with mixing depth, Buildup Index, and 20-foot standard windspeed[1/]

Buildup Index	Windspeed (m.p.h.)						
	2	4	6	8	10	12	14
MIXING DEPTH 3,000 FEET M.S.L.							
10	8,800	10,800	11,200	10,800	10,000	8,900	7,400
25	10,400	12,200	12,600	12,300	11,500	10,300	8,900
50	11,500	13,300	13,700	13,400	12,600	11,400	10,000
75	12,100	14,000	14,400	14,100	13,200	12,100	10,700
100	12,600	14,400	14,900	14,500	13,700	12,500	11,100
125	12,900	14,800	15,200	14,900	14,100	12,900	11,500
150	13,200	15,100	15,500	15,200	14,300	13,200	11,800
MIXING DEPTH 9,000 FEET M.S.L.							
10	9,100	11,000	11,400	11,100	10,200	9,100	7,700
25	10,600	12,400	12,900	12,500	11,700	10,500	9,100
50	11,700	13,600	14,000	13,600	12,800	11,700	10,200
75	12,300	14,200	14,600	14,300	13,500	12,300	10,900
100	12,800	14,700	15,100	14,700	13,900	12,800	11,400
125	13,200	15,000	15,400	15,100	14,300	13,100	11,700
150	13,500	15,300	15,700	15,400	14,600	13,400	12,000
MIXING DEPTH 15,000 FEET M.S.L.							
10	9,300	11,200	11,600	11,300	10,500	9,300	7,900
25	10,800	12,700	13,100	12,800	11,900	10,800	9,400
50	11,900	13,800	14,200	13,900	13,000	11,900	10,500
75	12,600	14,400	14,800	14,500	13,700	12,500	11,100
100	13,000	14,900	15,300	15,000	14,200	13,000	11,600
125	13,400	15,300	15,700	15,300	14,500	13,400	11,900
150	13,700	15,500	16,000	15,600	14,800	13,600	12,200

[1/] Approximate range of collected data is indicated by internal line.

APPENDIX C

TIMBER SALE CONTRACTS AND PROVISIONS FOR PREVENTION OF ENVIRONMENTAL DEGRADATION

TIMBER SALE CONTRACTS AND PROVISIONS FOR PREVENTION OF ENVIRONMENTAL DEGRADATION

Timber Sale Contracts

The Timber Sale Contract for Puzzle Creek awarded on December 11, 1969 contained the standard provisions in effect at that time in three divisions, A-specific conditions, B-standard provisions, and C-special provision. The A-clauses were specific for location, volume, etc., but nothing pertaining to air and water pollution. The B-clauses included some standard provisions included in all timber sales regarding the Protection of Stream Courses (B6.5), Erosion Prevention and Control (B6.6), Erosion Control Structure Maintenance (B6.63) and Slash Disposal (B6.7). The B-clauses were all very general.

The C-clauses contained some specifications affecting air and water pollution but again provided only broad guidelines. C5.2 required that "the purchaser shall file a plan with the Forest Service prior to burning," and admonished that debris should not be deposited in streams. C6.4 prohibited skidding in live streams and "minimum" crossings. C6.61 contains the major erosion prevention requirements as follows:

Prevention of Erosion C6.61

A. Except as provided in item B, purchaser shall locate spur roads according to operating schedule, B6.31. Such location shall include the marking of road centerline or gradeline and the setting of such construction stakes as are necessary to provide a suitable basis for economical construction and the protection of national forest lands. Maximum sustained grades for roads in this sale will be 8 percent.

B. Where the location of roads is designated or staked on the ground by Forest Service, construction shall be upon such locations.

C. Except where waived in writing by Forest Service, roads shall be so located that the distance between the toe of the fill and the stream channel shall not be less than 100 feet.

D. Bridges shall be constructed with the minimum encroachment on stream channels and to the length and height necessary for maximum streamflow. Approach fills will be riprapped or constructed so as to prevent fill material from entering the stream.

E. After specified roads are substantially completed for log hauling, the skidding of logs on the roadbed shall not be permitted.

F. Temporary drainage structures and earth fills in live and intermittent stream channels shall be removed after logging to prevent soil washing; except where adequate permanent metal or concrete culvert is installed, such removal may not be required.

G. Skidding with tractors within 50 feet of live streams shall not be permitted except in places designated in advance by Forest Service, and in no event shall skid roads be located in live or intermittent stream courses. Skid trails will be located high enough out of draws, swales, and valley bottom to permit diversion of runoff water to natural undisturbed forest ground cover.

H. During periods of accelerated water runoff, especially during the spring runoff and periods of heavy rainfall, purchaser shall inspect and open culverts and drainage structures, construct special cross ditches for road runoff, and take other reasonable measures needed to prevent soil erosion and siltation of streams.

I. Tractor skid trails in excess of 25 percent will be permitted only upon written agreement between purchaser and Forest Service.

J. Spur road surface width shall be limited to truck bunk width plus 4 feet; except where needed turnouts will be permitted equal to two times the bunk width plus 4 feet. If shovels or cranes with revolving carriage are used to skid or load, spur road surface width equal to track width plus tail swing will be permitted.

C6.62 sets forth erosion control required by the purchaser.
C6.7, C6.71 and C6.96 take care of slash disposal.

Erosion Control by Purchaser C6.62

A. Not later than 30 days subsequent to the completion of skidding on each unit or subdivision of the cutting area, unless otherwise agreed upon, purchaser may be required to out-slope or construct diagonal drainage barriers, and/or drainage dips, in all roads, firebreaks, and skid trails located on gradients above 2 percent. Such measures shall include:

(1) Discontinued roads--cross ditch, outslope, and remove berm.

(2) Spur roads to be retained--clean culverts and ditches and construct berms (where necessary).

(3) Skid trails--cross ditch, place dirt embankment barriers, place logging slash barriers and gully plugs, and outslope trough-shaped skid trails.

(4) Firebreaks--cross ditch, place dirt embankment barriers and gully plugs.

Location of all such drainage barriers and dips will be staked or otherwise marked on the ground by Forest Service.

B. Measures to be completed when road construction or logging is in progress and not fully completed at the time of shutdown follow:

(1) Roads shall be bladed so they will drain properly and not become waterways. Spur roads will normally be outsloped to dispose of surface water.

(2) Cross drains as staked by Forest Service shall be provided to prevent erosion.

(3) Culvert openings shall be inspected and cleaned.

(4) At locations staked or otherwise marked on the ground, berms and insloping shall be constructed to prevent rainwater and snowmelt from eroding fill slopes.

(5) Where berms are left, roads shall be insloped and disperal of water provided by cross ditches or culverts.

Slash Disposal C6.7

Slash consists of all debris resulting from logging and all fuels associated with construction of specified roads or other improvements.

Construction of Firebreaks C6.71

A firebreak (exposed mineral soil) not less than 14 feet in width shall be constructed along the high hazard perimeter of each clearcut unit prior to completion of logging. Purchaser shall construct a firebreak along the balance of perimeter of each clearcut unit as completed.

Landing Slash Disposal C6.76

All slash and cull logs accumulated at landings shall be piled in a manner suitable for burning.

The location of roads for erosion control, channel changes and borrow pits were included as part of the road design in the contract.

These provisions in addition to the design of the sale and the roads were believed to offer sufficient environmental protection to recommend that the area be clearcut.

Standard Contract Provisions

The Puzzle Creek sale is covered under Standard Provisions (Division B), adopted April 1966, whereas the Gildardt Flats sale is covered under a revision adopted July 1970. The revision is more extensive, definitive and precise regarding the stipulations of the Contract and the respective responsibilities of both buyer and seller. Both contracts stipulate that a representative of both Forest Service and Purchaser be readily available to issue and receive notices with respect to the Purchaser's operations. The policy on the Flathead Forest now is to appoint a representative whose assignment is to supervise the operations of each timber sale throughout the term of that sale, providing a degree of continuity in Sale Administration that formerly did not exist.

And examination of the B and C clauses in sales contracts does not show much change between the older and newer contracts. The difference seems to lie mostly with the enforcement of contract provision. It is obvious that the contract clause regarding the distance a road should be from a stream was violated on the Puzzle Creek sale. The toe of the road slope was into the stream or very close to it instead of the 100 feet prescribed in the contract. The old habit of not living up to the contract was still ingrained.

Special Provisions - Division C

The so-called C-Clauses represent special provisions inserted in the standard contract to meet specific requirements of the individual sale. This section covers specific requirements with regard to both road construction and maintenance and the timber extraction process. Historically, the C-Clauses with regard to the engineering aspects have been lengthy and detailed, whereas the requirements for the harvesting operation have been minimal.

The Gildart Flats Contract is somewhat more specific with regard to C6.6--Erosion Prevention and Control, but not sufficiently different to represent a great leap forward. Considerable emphasis is placed upon debris disposal with respect to both road right-of-way clearing and the harvesting activity, this being a cosmetic requirement to overcome aesthetic objections. This requirement, however, requires the yarding and decking of unutilized material, to be burned later. Although the merchantability limits have been reduced to 5.5 inches, d.i.b., there will be a considerable volume of material that will have to be moved from the site to the decks. The additional site disturbance and associated burning may result in a greater soil and air pollution impact than if a more conventional type of debris disposal were required. The trade-off here needs further study before the practice becomes generally accepted.

Several rangers agreed that the guts of the environmental provisions were contained in the C clauses, and that C clause could be used to strengthen the environmental requirements. But the rangers largely relied on the standard approved C clauses. These had been agreed to by the Forest Service and the timber industry and they could not be changed without approval. This was not collusion so much as an understanding of what would be required as protection against imposition of some costs of which the operator was not fully aware. One ranger wrote a new C clause and included it in the Gildart Flats sale. The regional timber staff objected because this was not one of the agreed-to clauses. The supervisor backed the ranger and got approval to use the C clause. The opportunity has not been extended, but it seems that the C clauses need to be re-examined and perhaps revised to meet new requirements and hopefully added to as quantitative knowledge on water and air pollution effects are better understood. One way would be to encourage innovative thinking from the field and to permit special provisions for particular conditions.

What needs to be encouraged is the type of a site analysis and decision making which is underway on the Flathead. Much of the environmental problem on National Forests lies with blanket decision making which emerged from higher offices and which did not consider the specific field problems. Situational management is an improvement and needs to be encouraged.

Use of the C clauses is one device and actually only a minor one. The greater opportunity for the avoidance of environmental damage will have to come in the whole plan of management of the forest, the selection and design of the area to be harvested and the necessary roads required, the selection of harvesting method, the care with which the harvesting is done, and strict enforcement of the various precautions. This approach will prevent damage from occurring rather than trying to repair the damage after it has occurred.

Timber Sale Administration was for years assigned to new employees of the Agency. Inasmuch as new employees were very transient in the organization, administrative continuity was lacking--and because of the inexperience of the personnel, they were reluctant to enforce contractual provisions. With personnel ceilings the Districts now have a degree of personnel stability that provides a greater continuity, with associated responsibility and authority. In personal discussions with field representatives, they indicated a good deal of personal satisfaction in having the responsibility and authority--as well as accountability--with respect to their various assignments.

The point is, that the contract stipulations, even prior to the 1970 revision, were quite specific and contract violations or oversights were permitted for several reasons: (1) a general insensitivity toward the several resources, (2) a lack of staff specialists to assist in the planning phase (a general reluctance by the Agency to recognize need), (3) high turnover rates in personnel, as previously mentioned, (4) lack of back-up support--District Ranger, Supervisor, R. O., W. O.

The Forest Service has had, under both contracts, the provision to suspend or terminate the contract under the Breach Clause B8.25 under the former contract, B9.3 under the present contract.